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THE MORPHOLOGICAL SIMILARITY OF CERTAIN LUTEAL CYSTS AND ENDOMETRIOSIS OF THE OVARY

E. S. J. KING, M.D. (MELB.), F.R.C.S. (ENG.), MELBOURNE, AUSTRALIA
Stewart Lecturer in Pathology, University of Melbourne

EXAMINATION of the records of blood cysts of the ovary of the past three decades discloses the fact that the diagnosis of endometriosis of the ovary is frequently found while mention of other conditions, particularly the tarry luteal cysts, is rare. Previously the blood cysts, with the exception of the obviously luteal, formed a heterogeneous group for which numerous hypotheses had been put forward.

The first suggestion that some of these cysts were endometrial (muellerian) in origin was made by Russell in 1899, and this idea was seized upon and since that time many reports of cases ascribe this origin to similar cysts.

It was about the same period (1898) that Fraenkel (5) showed that some of the luteal cysts containing old blood developed a lining of columnar cells. Many luteal cysts leave little doubt as to their origin, but some of them lose many of the characteristics by which their origin may be easily recognized. It is these atypical forms which it is proposed to discuss and particularly those which have developed the "epithelial" lining described by Fraenkel.

A priori, since corpora lutea occur so commonly in the ovary, one would expect to find changes in them much more frequently, rather than to discover a curiously aberrant tissue—endometrium, which is apparently derived from a neighboring organ.

Is it that the luteal cysts are too obvious to raise question and of too little interest to be more than noticed? Or has the possibility of the luteal origin of the epithelium-lined glands and cysts been overlooked? A consideration of the microscopic appearances and one, at least, of the complications of these luteal cysts will readily make it clear that they occur more commonly than, and equal in interest, those of "endometrial" character.

The effect of the rupture of endometrial cysts on the peritoneum, with the development of secondary endometrial growths and a resulting severe inflammatory reaction, has been frequently described. Why is it, though, that a similarly severe reaction to the presence of luteal cells, derived from a tarry luteal cyst, has been almost unnoticed? Brakeman and Shaw have reported cases of this most interesting condition, and the writer has observed a case in which a similar phenomenon occurred.

In view of these circumstances, a description and discussion of tarry luteal cysts and their relation to endometriosis will not be out of place.

That failure to differentiate the two conditions sometimes occurs was suggested by the observations: (1) that the diagnosis of endometriosis was made in cases of luteal cysts showing the epithelial lining and (2) that the evidence on which the conclusion of the endometrial origin is based, in some reported

cases, is inadequate and in some cases even suggests a luteal origin. It is possibly the suggestion of the bizarre in the diagnosis of endometriosis that appeals to the imagination.

There are, of course, some cases in which the evidence at present allows only of a diagnosis of "endometrial" glands, but it is proposed to show that other sources should be considered before concluding that the cysts are necessarily of muellerian origin.

ENDOMETRIAL CYSTS OF THE OVARY

Endometrial structures found in the ovary take the form of glands and, by the dilatation of these—cysts. These cysts usually contain chocolate or tarry material which is derived from old blood. On this hypothesis, the reason given for the bleeding is that, since the glands functionally, as well as morphologically, resemble those of the normal endometrium, hæmorrhage occurs into them during menstruation (2).

The glands frequently occur on the surface of the organ and adhesions form between the ovary and the neighboring structures (14, 16). This is due to the implantation of the glands on the surface of the surrounding organs and to the subsequent fibrosis inaugurated by the presence of the gland tissue. This characteristic will be referred to later.

Sometimes the cysts reach a size of several (3 to 6) centimeters and rupture may occur into the peritoneal cavity.

Microscopically, the glands are lined with columnar epithelium which has a supporting stroma similar to that of the endometrium of the uterus (15). Around this again is the tissue of the surrounding organ—fibrous tissue—and, in some places, muscle.

While this is the typical appearance, many variations occur; the epithelium may become flattened, the stroma may disappear, thus leaving little but neighboring characteristic glands to give a clue to the true diagnosis.

It would appear, thus, that in a typical case, there could be no possibility of doubt in the diagnosis of the condition, but that in atypical forms difficulty might arise.

We shall now consider the cysts that so closely resemble those described, but to which a different origin is assigned.

TARRY LUTEAL CYSTS

It is unnecessary to consider the simple luteal cysts, except to point out that they are of two types:

1. The corpora lutea which become cystic (3, 4).

2. The follicles which become atretic and in which the cells undergo "luteal" change without forming a corpus luteum (10).

In either case the cellular layer becomes invaded by connective tissue and the cells become separated and altered in their morphological characteristics (Fig. 4). Some of the cysts which arise directly from the follicle have been named, by Shaw, granulosa luteal cysts, in order to indicate that cells derived from the granulosa layer of the graafian follicle are present. These cysts are well shown in the "luteal" cysts associated with hydatidiform mole.

Hæmorrhage occurs into many of these cysts and as the blood is not (8, 9, 11, 19) absorbed and becomes old it assumes a chocolate or tarry consistency. These cysts are referred to as the tarry luteal cysts and there are thus a number of types of these cysts (Fig. 5). These are: (1) the tarry corpus luteum cysts arising by cystic change and hæmorrhage into a formed corpus luteum; (2a) the tarry granulosa luteal cyst—the tarry form of the cyst described above; (2b) the tarry theca luteal cyst. In some forms arising from the atretic follicle, cells of the theca interna layer can be found and there is no evidence of the granulosa layer. The name thus indicates the type of cell found in the wall of the cyst.

1. The tarry corpus luteum cyst typically shows many of the characters of corpus luteum. The convolutions are marked and two types of cells are clearly differentiated—luteal and paraluteal. The later degenerative changes will be described subsequently.

2a. The tarry granulosa luteal cyst. The cysts of this type that have been observed have been large. In one of the author's cases the cyst completely replaced the ovary and measured 15 centimeters in diameter while in another the cysts were bilateral and both measured 8.5 centimeters in diameter.

In the wall, two types of cell may be observed. In the outer portion, there are the

cells which correspond to the theca interna layer of the graafian follicle. The cells are very atypical luteal cells, having a very different appearance from the true luteal cell in any of its stages. They are usually larger than the cells of the corpus luteum of pregnancy, they are spheroidal in shape, and the protoplasm is granular with a considerable, though varying, amount of blood pigment. The nucleus stains well, is spherical and eccentrically situated. The cell outline is often indistinct, and the cells themselves are separated by distinct spaces (Fig. 14). They are arranged more or less definitely in radial rows and even when few cells remain, this arrangement, which is followed by the fibrous tissue, as well as the cells, may still be observed.

The granulosa cells occur only in a few parts of the wall, stain very badly, and have very indefinite cell outline. They are somewhat larger than the cells just described.

2b. The tarry theca luteal cyst differs from the former in that no cells corresponding to the granulosa cells are found in the wall. The cysts are usually small and occur in the substance of the ovary. The examples observed by the writer varied from 6 millimeters to 3.5 centimeters in diameter. They are spherical and show no convolutions suggesting the corpus luteum. They apparently develop from the follicle of the atretic type.

Microscopically, the cells resemble those described in the outer layer of the cyst previously described. The reasons for considering that the cells are theca interna cells rather than granulosa cells are: (1) The theca interna cells morphologically resemble these cells more closely than the granulosa cells, e.g., in the amount of pigment in the protoplasm; (2) theca interna cells are more numerous than granulosa cells in the atretic forms of the follicle, from which this cyst probably arises; (3) when granulosa cells occur they form a distinctive layer and are more degenerate; and (4) in all cases in which granulosa cells are found in the normal or abnormal follicle, a layer of cells corresponding to the theca interna cells may be found external to it. Thus, in the tarry theca interna cysts, if we regard them as granulosa cells, no cells could be found to correspond to the theca interna cells.

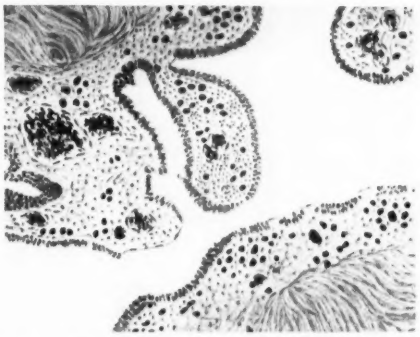

Fig. 1. Section of a collapsed tarry luteal cyst showing the columnar epithelial lining. The subjacent stroma containing the pseudo-xanthomatous cells is apparent. The crypts which are sometimes cut transversely are seen. Hæmatoxylin and Van Gieson. ×140.

We thus have three well marked types of tarry luteal cyst. Other characteristics of these cysts may be readily observed in the routine examination of ovaries and a complete description is beyond the scope of this paper. There are probably more types than have been described—the writer has observed examples which do not correspond absolutely to these types, but whether they are merely variations or separate forms is uncertain.

Despite their different origins, they are all similar in that degeneration of the cells occurs, the walls become invaded by connective tissue which becomes hyaline, and thus the cysts may show only a few atypical luteal cells in the wall.

All of these cysts also have in common the occasional formation of an "epithelial" lining (Fig. 1). The possible origin of this lining has been frequently discussed and for our present purpose its presence is the important feature. Its cells vary from a flattened endothelium-like form to that of a bold columnar character, with basally situated nuclei (Figs. 2 and 6). When flattened or absent elsewhere, these cells are often found to be columnar in the crypts, which may be seen along the surface of the cyst wall. It is thought that they appear at first in these crypts and as the cyst becomes older, the epithelium becomes columnar over even the more exposed parts.

Immediately below these cells, there is an accumulation of connective tissue cells (Fig.

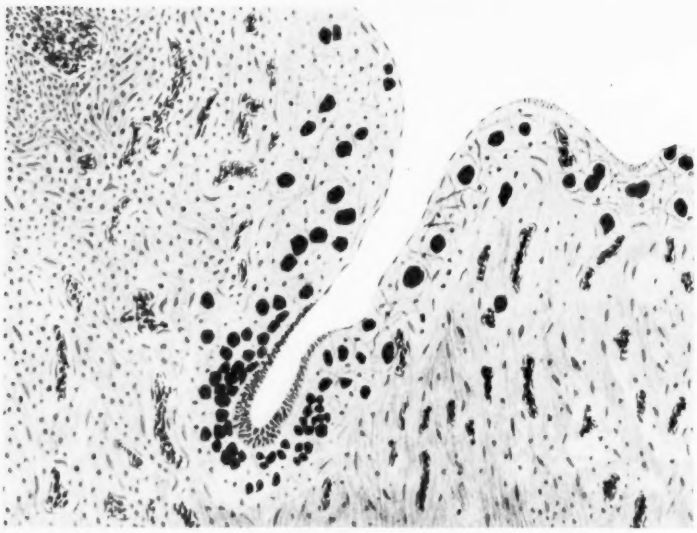

Fig. 2. Portion of the wall of an old tarry luteal cyst. The formation of the columnar epithelium in the depths of the crypts is well seen. The pseudo-xanthomatous cells are numerous. ×140.

11) which may, at times, closely resemble the stroma seen around the endometrial glands. In this tissue there are large pigment-containing cells described as "pseudo-xanthomatous" by some writers (Figs. 1, 2, 9, 12, and 13). Deeper among the tissue may be found the luteal cells (Fig. 11). Frequently, these are not found in the areas where the epithelium occurs, but on following the cyst wall round under the microscope, portions of it are found in which there is no epithelium but in which luteal cells are in abundance; a feature which has an important bearing on the classification of any particular specimen.

Occasionally, when the cells have disappeared, the arrangement of the connective tissue, which frequently shows the characteristic forms seen in retrogressing follicles and corpora lutea, gives an indication of the original presence of luteal cells (Fig. 7). The

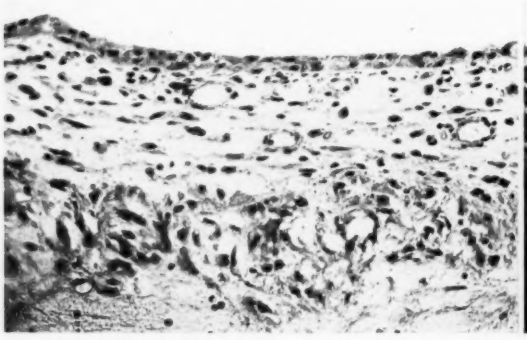

Fig. 3. Photomicrograph of portion of the wall of an obvious luteal cyst. Luteal cells are present with an inner fibrous layer and the internal epithelium. ×180.

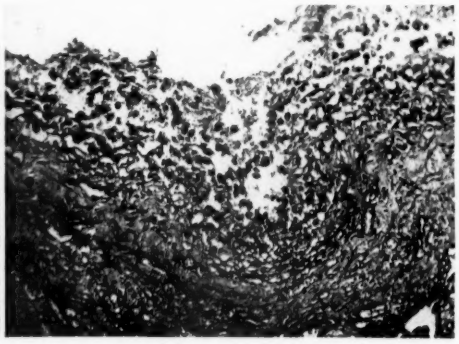

Fig. 4. Portion of the wall of an old tarry cyst. The atypical nature of the cells is apparent. The cellular layer is invaded by connective tissue. ×50.

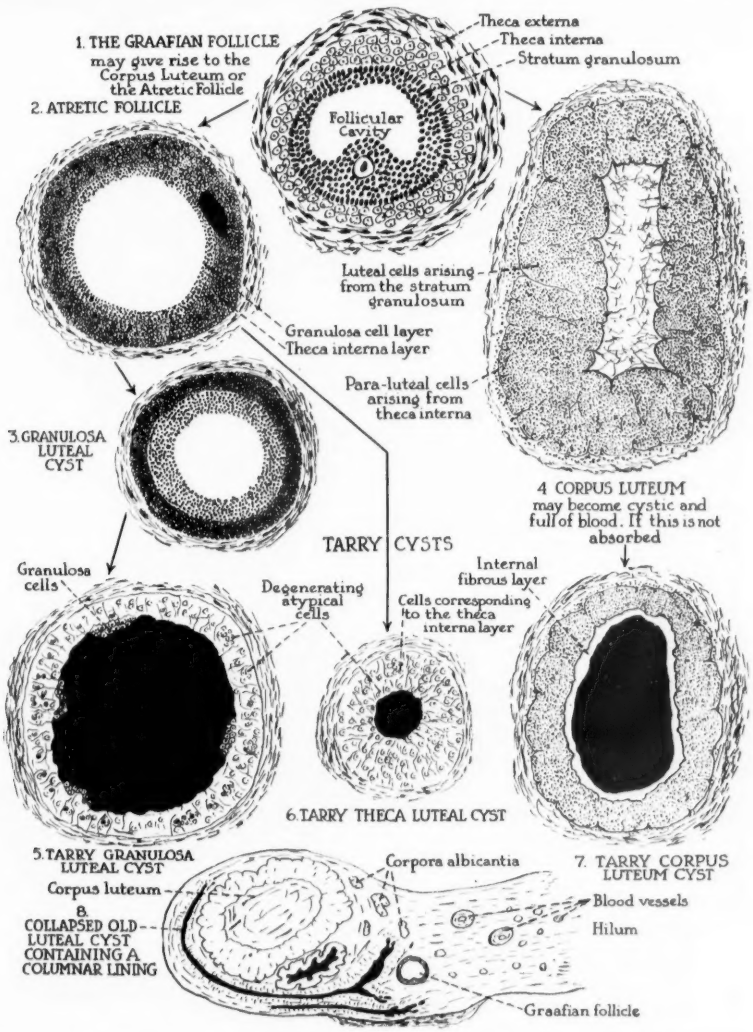

Fig. 5. Diagrammatic representation of the relationships of the tarry luteal cysts. 1. Graafian follicle showing the stratum granulosum and the theca interna and externa. 2. The atretic follicle develops from the graafian follicle by degeneration of the granulosa cell layer and proliferation of the theca interna layer. 3. The granulosa luteal cyst. In some cases of atresia of the follicle, the stratum granulosum proliferates instead of degenerating. This occurs particularly in the cases of hydatidiform mole and also sporadically. 4. The corpus luteum develops from the graafian follicle which sheds its ovum into the peritoneal cavity. The luteal layer arises from the granulosa cells while the paraluteal layer develops from the theca interna layer. 5. The tarry granulosa luteal cyst. This contains old blood and is the hæmorrhagic counterpart of the granulosa luteal cyst. The cells in its wall are degenerate and atypical. 6. The tarry theca luteal cyst (Fig. 4). It is derived from the atretic follicle. The cells are atypical and there are no cells corresponding to the granulosa cell layer. 7. The tarry corpus luteum cyst. This comes from the corpus luteum cyst. The cells ultimately become degenerate and separate from each other as in the other cysts. Any of these cysts may develop an internal epithelial lining. 8. A representation of how the cysts frequently appear in the ovary. They collapse and then are only epithelium-lined, blood-containing slits (Fig. 11).

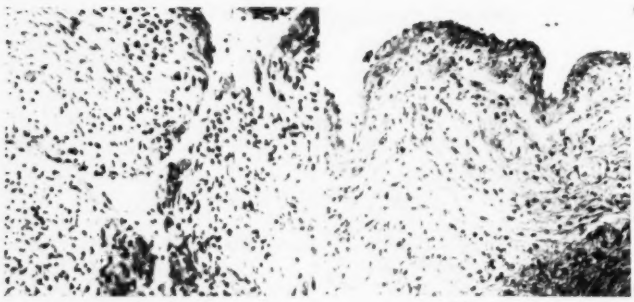

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 6. Part of a collapsed tarry luteal cyst showing the connective tissue lining. There is no columnar lining in this case, but a few endothelium-like cells are present. This appearance supports the view of some investigators that the columnar cells arise by metaplasia from endothelium. ×105.

Fig. 7. The wall of a tarry luteal cyst with an epithelial lining. The luteal cells have almost disappeared, being replaced by hyaline fibrous tissue. ×105.

Fig. 8. A collapsed tarry luteal cyst. The intense staining of the epithelial cells with hæmatoxylin is apparent. The crypts are seen cut across in section, thus giving a superficial resemblance to glands. ×65.

connective tissue is hyaline in nature and therefore, being very stable, maintains for a considerable period, the position and arrangement which it originally adopted. Schwarz also has remarked that it is possible to recognize luteal cysts, by the arrangement of the connective tissue and, possibly, the presence of disintegrated nuclei and cells, even in the absence of luteal cells.

COMPARISON OF ENDOMETRIAL WITH TARRY LUTEAL CYSTS

Morphology. The macroscopic differentiation of endometriosis from tarry luteal cysts is not possible. It is, no doubt, the experience of many pathologists who have been interested in aberrant endometrial glands, to find that many blood cysts of the ovary, at first considered to be endometrial, have proved to be, on closer inspection, luteal in origin. Adhesions to neighboring structures occur with both endometrial and luteal cysts, so that even this feature is of no value in differential diagnosis.

Microscopically, also, the resemblance may be remarkable.

1. *The epithelium.* As has been shown, both types of cyst are lined with epithelium, which varies from flattened cells of an endothelium-like type to tall columnar cells. There is one characteristic which sometimes suggests the diagnosis: the heterotopic epithelium of the luteal cysts usually takes the hæmatoxylin stain much more intensely than do the structures around about (Figs. 8 and 10), while epithelium not arising in luteal cysts stains much more in uniformity with its neighboring cells.

It has been stated that the epithelial cells of the tarry luteal cysts do not bear any resemblance to endometrial gland cells. The writer strongly disagrees with this statement. In some cases, the resemblance is remarkable and requires careful examination for their differentiation.

As has been stated above, the columnar cells are often first seen in the crypts in the wall of the luteal cyst, and it sometimes happens that these crypts are cut transversely in section, instead of longitudinally (Fig. 8). It is apparent that an appearance, superficially resembling that of endometrial glands, will thus be given. Earlier, this appearance led the writer to accept the endometrial hypothesis as explaining the source of these structures, until the examination of other and more typical portions of the cyst suggested the origin from a luteal cyst.

We thus see that the types of cells and the manner in which they form "glands" may render the two forms indistinguishable.

2. *The stroma.* Both types of cyst possess a subepithelial stroma. In the endometrial glands, this is like the stroma of the endometrium of the uterus. In the luteal cysts, it consists of round and spindle cells which

Fig. 9.

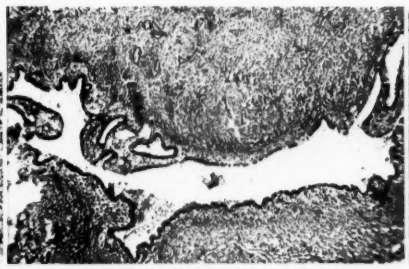

Fig. 10.

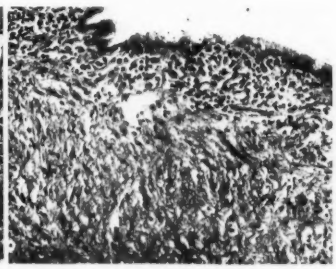

Fig. 11.

Fig. 9. The wall of the cyst seen in Figure 8. The epithelium, stroma, and pseudo-xanthomatous cells are seen. ×45.

Fig. 10. A cyst similar to that seen in Figure 8. The arrangement of the hyaline tissue resembling the hyalinization of a luteal body is seen. ×45.

Fig. 11. The wall of a cyst showing the epithelium stroma, and hyalinized luteal tissue. ×105.

contain large pigmented cells and many dilated vessels.

Again, it is stated that this stroma does not, in any way, resemble the stroma of aberrant endometrial glands. This statement certainly does not apply to the less typical examples of either condition, for the two may approach one another till they are indistinguishable. Endometrial glands may show many variations from the "normal" appearance, while the subepithelial structures of the luteal cysts may in some parts present an extraordinary resemblance to endometrial stroma. This is well shown in Figures 15, 16, and 17.

3. *Large phagocytic cells.* These cells, described as "pseudo-xanthomatous," occur in cysts of both types. They are larger than luteal cells, contain many pigmented granules in their cytoplasm, and occur in greater numbers where the epithelium is best developed (Figs. 1, 2, 9, and 13).

4. *The surrounding tissue.* In the luteal cysts, it is the immediately surrounding tissue that gives the diagnosis, even should luteal cells be absent (Fig. 10). The fibrous tissue is arranged in a characteristic manner between the cells, it becomes hyaline, and this formation remains even after the cells have disappeared.

Physiology. Structural alterations occur during the different stages of the menstrual cycle.

In this particular, also, the cysts of both types are similar. Bleeding occurs into the endometrial cysts at menstruation and hæmorrhage also takes place into luteal cysts during or immediately after menstruation.

It is clear in some reported cases that an ovarian cyst has been considered to be endometrial, merely because the bleeding into a cyst bears some, not necessarily exact, relation to the menstrual period.

In a general way, therefore, we are not assisted in our differential diagnosis by the physiological behavior of the cyst.

THE RELATIONSHIP TO ASSOCIATED ABERRANT ENDOMETRIUM

Endometriosis is frequently multiple and the presence of endometrial glands in other organs has been considered presumptive evidence that the tissue in the ovary is also endometrial.

It has recently been suggested, however, that an important factor in the etiology of endometriosis is the presence of abnormal, possibly excess, hormone arising in the ovary. The hormone is probably of the luteal or follicular type. In the hæmorrhagic luteal cysts under discussion, there is certainly excess luteal tissue and probably excess and abnormal hormone. This has been demonstrated by the hyperplastic condition of the endometrium which has been present in some cases. Meyer suggests that such a hormone may be responsible not only for hyperplasia of the normal endometrium, but also possibly the development of endometrium in abnormal situations. What value, if any, may be placed on these hypotheses is beyond the range of this discussion, but the important observation is

Fig. 12.

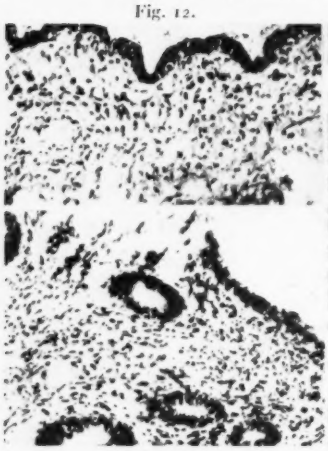

Fig. 15.

Fig. 13.

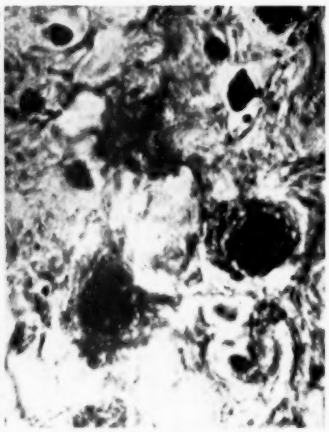

Fig. 14.

Fig. 12. A portion of the wall of the cyst shown in Figure 10. ×110.

Fig. 13. The wall of a tarry luteal cyst similar to that shown in Figures 1 and 10. ×110.

Fig. 14. A high power view of luteal cells seen in the walls of these cysts. The cells have an indefinite outline, eccentric nucleus, and granular vacuolated protoplasm. ×900.

Fig. 15. Portion of the wall of a cyst from the same ovary from which the cyst seen in Figure 8 was taken. Another portion of the cyst was obviously luteal. The resemblance to endometrial tissue is considerable. ×110.

that endometriosis may be associated with other disease of the ovary, particularly luteal abnormalities. In any case of multiple endometriosis, therefore, the too carefree conclusion that the blood cysts of the ovary must be endometrial in nature is undesirable.

COMPLICATIONS

For many years, the extraordinary reactionary fibrosis following the rupture of endometrial cysts into the peritoneum caused much discussion. It was decided, at first, that the old tarry or chocolate material must have some special irritating power. Later, it was shown that it was small pieces of endometrial tissue growing in the peritoneum which caused the intense reaction. That a similar result may arise from the rupture of tarry luteal cysts has been overlooked except by the two workers previously mentioned.

Fig. 16.

Fig. 17.

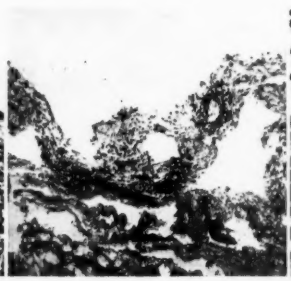

Fig. 18.

Fig. 19.

Fig. 16. Subepithelial "glands" from the same cyst as that seen in Figure 15. ×100.

Fig. 17. Portion of the wall of a luteal cyst. Some portions were typical. No other "glands" of this nature were found in the ovary. The resemblance of the stroma to that of endometrial glands is remarkable. ×100.

Fig. 18. Section of peritoneum from an area of fibrosis and thickening which followed on the rupture of a tarry luteal cyst. ×60.

Fig. 19. Section of a nodule of the peritoneum showing the luteal cells which are responsible apparently for the inflammatory reaction and fibrosis. ×225.

This occurrence again shows the exceedingly close resemblance that these cysts bear to each other. In the case of the tarry luteal cyst, the reaction of the peritoneum is due to the presence of the luteal cells (Figs. 18 and 19) and heterotopic epithelium derived from the cyst. The epithelium sometimes forms small spaces in the peritoneum, containing tarry material, similar to that of the original cyst and, macroscopically, these may be seen projecting from the peritoneum as small bluish-black nodules or cysts. In the case observed by the writer, some of the cysts contained only yellowish fluid and one of the cysts was of a large size—3 centimeters in diameter. The resemblance of these structures to secondary endometrial growths is immediately apparent and the need for careful differentiation is obvious.

It will be seen from the foregoing, as also will be shown by a careful routine study of ovaries, that tarry luteal cysts and endometrial cysts have many features in common.

SUMMARY

1. Endometrial cysts of the ovary and tarry luteal cysts possess many features in common.

2. They are indistinguishable macroscopically.

3. Microscopically, diagnosis requires careful study, since (1) the epithelium in both cases may be similar; (2) the subjacent stroma in the luteal cyst may closely resemble that of endometrial glands; (3) gland spaces may be seen in both; (4) pseudo-xanthomatous cells occur in both; (5) the characteristic structure of the luteal cyst may not be apparent in all parts of the wall, so that a thorough study in doubtful cases is essential.

4. Their similarity extends to their physiology and complications.

5. Tarry luteal cysts sometimes rupture into the peritoneal cavity, thus producing secondary blood cysts and a severe inflammatory reaction similar to that produced by "endometrial" cysts.

CONCLUSIONS

The writer's experience suggests that the endometrial diagnosis has been made too frequently and on insufficient evidence or erroneous interpretation. The frequency with which he is able to demonstrate a luteal nature for cysts of this kind suggests that many of those recorded are possibly luteal in origin.

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THE "FORMES FRUSTES" TYPE OF PERFORATED PEPTIC ULCER[1]

HARRY A. SINGER, M.D., CHICAGO
Attending Physician, Cook County Hospital
AND
ROGER T. VAUGHAN, M.D., F.A.C.S., CHICAGO
Attending Surgeon, Cook County Hospital
From the Department of Medicine, University of Illinois College of Medicine, and the Department of Surgery, Cook County Hospital

JUDGING from textbooks and systems of surgery, perforation of a peptic ulcer into the free abdominal cavity is considered practically always fatal unless the hole is closed surgically. The current impression of the clinical picture and natural course of the disease is as follows: The patient is seized by a violent, intolerable, epigastric pain which frequently results in collapse. The initial pain and accompanying symptoms may or may not be followed by a temporary remission, the so-called period of repose. In either event, evidences of diffuse peritonitis soon appear and rapidly progress. Without operation death ensues within a few days in all but a small proportion of the cases—generally quoted as less than 5 per cent. Of the patients who recover from the diffuse peritonitis a certain number develop intraperitoneal abscesses which may eventually require surgical drainage. In addition to the group presenting the classical type of perforation just described, there is a group of cases in which the overwhelming pain at the onset is rapidly followed by progressive collapse and death within a few hours. The clinical picture of this fulminant type of perforation is likewise well known to the general profession. There is, however, a third variety which heretofore has attracted but little attention and has therefore failed to receive universal recognition. Such cases are referred to in the German literature as "gedeckte Perforation" (Schnitzler) and in the French literature as "perforation fermée et isolée" (Delagenière), while American and English authors have chosen the term "subacute perforation" (Lund, Moynihan). This type of perforation, although ushered in by symptoms of a perforative peritonitis, fails to develop evidences of diffusely progressive peritonitis as in the classical form but, instead, produces rather mild symptoms which quickly abate. In order to emphasize the essential clinical difference between the classical and the mild perforation which is actually acute rather than subacute, we have chosen the term *formes frustes* in preference to the other previously suggested names.

MECHANISM

What determines whether a perforation should result in a classical clinical picture or in mild and transient symptoms? When a perforation is followed by spontaneous recovery, it is generally assumed that rupture occurred into a preformed sac or into adhesions. This assumption which is based upon inference appears in the light of the knowledge gained from surgical observations to be contrary to fact. The available evidence indicates almost indubitably that perigastric adhesions follow rather than precede the perforation. The indirect testimony in support of this contention entailing as it does polemic discussion may be omitted since direct evidence is readily available.

In a number of *formes frustes* cases we have succeeded with the aid of the fluoroscope in demonstrating free intraperitoneal air which could be made to shift to all parts of the abdomen on change of the patient's position. In most of these cases for one reason or another operation was not performed but the antecedent history of ulcer, the acute onset with symptoms and signs of upper abdominal peritonitis, the subsequent barium meal examination, and the clinical course rendered it clear that a perforated peptic ulcer was the cause of the pneumoperitoneum. These patients recovered spontaneously in spite of their free perforations. Even more convincing than the demonstration of free air is the fact that in a number of cases in which operation was performed no perigastric sac or adhesions which

[1]Read before the Chicago Surgical Society, April 5, 1929.

appeared older than the perforation could be discovered. In some of these cases, although gastric contents were found lying remote from the region of the stomach and the perforation was left unsutured because already covered over or sealed, the patients went on to a recovery.

There can be little doubt, therefore, that the speedy spontaneous recovery which occurs after some perforations is not due to preformed adhesions but to a change which follows rather than antedates the rupture. This change consists of the early spontaneous sealing or plugging of the hole. As a consequence of obturation of the perforation, instead of a continuous leakage, such as occurs in the classical case when left unsutured there results in the *formes frustes* type a trifling or at most a limited escape of gastric or duodenal content. The peritoneum is readily able to cope with a small amount of foreign liquid which is relatively sterile, and therefore but slight peritoneal disturbance ensues. The various methods and agencies by which the perforation becomes spnntaneously occluded have been mentioned in previous papers (Singer, and Vaughan and Singer).

Fig. 1. Case 1. Pneumoperitoneum from perforated peptic ulcer 4 days after rupture and a few hours after admission to hospital. No operation. Recovery.

INCIDENCE

It is universally taught even by most of those who have written upon the subject that the occurrence of the *formes frustes* type is uncommon as compared with the incidence of classical cases. We held to this teaching until we learned to recognize the clinical picture of the mild cases when we were struck by their relative frequency. Most of the patients suffering from this condition felt fairly well at the time of admission to the hospital and entered in order to convalesce or on account of the persistency of a mild pain. One patient entered because he was curious to learn the diagnosis. The fact that more than two-thirds of the *formes frustes* cases were assigned by the admitting physician to the medical service indicates the mildness of the symptoms at the time of entrance, for it is the policy in our examining room to send a patient to a surgical ward whenever the suspicion of an "acute abdomen" is entertained. We were able to diagnose these cases in spite of the mild picture they presented by a painstaking analysis of the history with special reference to the presence of previous ulcer distress and the details of onset of the recent acute illness.

In order to obtain some idea of the incidence of the *formes frustes* type, we canvassed as many wards of the Cook County Hospital as we could, through the courtesy of other members of the attending staff, during the months of January, February, and March of this year. Undoubtedly, we failed to uncover some of the *formes frustes* cases but nevertheless succeeded in collecting data on 14 cases. During the same period of time only 12 cases of classical perforated ulcer were admitted to the hospital. We are quite convinced that this number represents about all the cases of classical perforation that entered during the 3 months since practically all our "acute abdomens" with grave symptoms have been either operated upon or autopsied. It would seem from our statistics that the milder cases are even more frequent than the classical ones, an observation which appears rather incredible.

Fig. 2. Case 1. Roentgenogram taken 24 hours later than Figure 1.

The period over which this clinical study was made is obviously too short to permit drawing final conclusions, and we merely submit the figures for what they are worth. Nevertheless we are prepared to state confidently that the *formes frustes* perforation is not of uncommon occurrence and that it is frequently overlooked.

SYMPTOMATOLOGY

The onset of perforation is preceded in over half of the cases by periodic attacks of chronic ulcer distress usually for a period of one or more years. In the majority of the patients for one to several days prior to the actual perforation, prodromal symptoms consisting of pain, vomiting, and epigastric tenderness are noted. The pain is more severe, of different character, and less responsive to alkalis than the ordinary ulcer distress. Vomiting is more persistent than in the usual case and often fails to relieve the pain. The patient is aware of a point of tenderness in the epigastrium, excited by even slight touch. In practically all instances, however, and not infrequently without even the slightest previous abdominal discomfort the onset is extremely abrupt and sudden. In fact, up to this point it is practically identical in all respects with the onset of perforation in the typical case except perhaps in intensity. The pain which is located usually in the epigastrium is violent in character and causes the patient to double up and writhe about in agony. As a rule the pain is not quite so excruciating as in the classical case. The prostration which accompanies the pain is not so overwhelming or so striking in the *formes frustes* type; nevertheless the picture the patient presents is usually a quite dramatic one. If the abdomen is examined within the first few hours or so after perforation, the same board-like rigidity and upper abdominal tenderness will be elicited as in the classical case.

Within a few hours after the occurrence of the perforation, that is, from 2 to 10 hours, the initial symptoms may practically subside leaving the patient in a state of comparative comfort. If the patient is seen during this quiescent period, the presence of an abdominal catastrophe may not be suspected. Frequently, however, evidences of peritonitis appear and the subsequent course is dependent on the amount and character of the escaped gastric contents. In those cases in which only a small quantity of relatively sterile duodenal fluid has escaped and merely a mild, local peritoneal reaction has been excited, little discomfort may be felt and this but for a short period of time. Some of the patients with trifling leakage feel quite well within a few hours after onset and unless otherwise instructed will resume their normal activities. Extravasation of a considerable quantity of food and secretion from the stomach, however, will produce a more or less diffuse peritonitis with a commensurate increase of the symptoms. In these cases, pain of a rather severe nature associated at times with vomiting will persist as a rule for several days following perforation. The pain generally is felt in the epigastrium, much more frequently to the right than to the left of the midline.

In cases in which the pain was originally perceived in the upper abdomen, it frequently

occurs that at the time the patient comes under observation the pain is felt exclusively in the right lower quadrant. This shifting of the pain site is due to gravitation of the escaped fluid into the right iliac fossa. Unless specific inquiry is made no history of initial upper abdominal pain may be elicited. It is in this type of case particularly that the mistaken diagnosis of appendicitis is so frequently made. When the inflammation extends to the subphrenic region on the right side, the pain may be experienced in the right upper or lateral abdominal region. Hiccough may be the chief subjective manifestation of subphrenic localization. It tends to be troublesome and incessant and may constitute the patient's presenting complaint. The fever is usually subfebrile in degree, rarely reaching above 100 degrees F., except in the more severe cases. The leucocyte count ranges between 10,000 and 20,000 with a relative increase of the polymorphonuclear leucocytes.

Physical examination during the stage of peritoneal reaction discloses indications of intra-abdominal inflammation which as a rule are more or less diffuse. Tenderness is elicited in the upper abdominal region at the site of, and adjacent to, the region of perforation and frequently in the right lower quadrant also. In those cases which are mistaken for appendicitis the error results from neglect to palpate the entire abdomen, to percuss the liver dulness, and to listen to the peristaltic sounds, for in all instances so far as our experience goes the tenderness when present over McBurney's point is not restricted to this one site but can be elicited in other portions of the abdomen also. The rigidity in this second stage is mild as compared with the board-like resistance encountered shortly after the acute onset. The muscular defense which is noted upon palpation corresponds roughly to the distribution of the tenderness. Peristaltic sounds are usually much diminished. Tympany is seldom pronounced early but some slight or moderate distention usually appears by the second day. If the escaped fluid reaches the subphrenic space, a peritoneal rub may be heard over the hepatic region synchronous with respiration. This friction rub was noted in two of our recent cases and in the first of the two was the means, together with the hiccough, of attracting our attention to the possibility of a perforated ulcer. Obliteration of liver dulness is only rarely demonstrated in the *formes frustes* cases presumably because leakage is only slight.

Fig. 3. Case 1. Three days later than Figure 1.

X-RAY EXAMINATION

Fluoroscopic examination undertaken immediately upon entrance to the hospital shows in only a part of the cases the presence of free intraperitoneal air and only occasionally is the amount of escaped gas as large as in the classical case. As a rule, only a thin zone of shifting radiolucence is seen. In some instances of *formes frustes* perforations we observed limitation of motion of the right diaphragm which led us to consider this phenomenon an indirect sign of upper abdominal peritonitis. Occasionally we found air in the right upper abdominal quadrant but were unable to differentiate clearly without a

Fig. 4. Case 1. Four days after Figure 1.

barium enema between intracolonic and extracolonic gas. We have refrained from subjecting these patients with suspected perforations to X-ray examination with barium until from 7 to 10 days after the onset of the acute attack. In most of the instances we have succeeded at the end of this time in demonstrating an ulcer niche of the stomach or a deformity of the duodenum.

CLINICAL COURSE

The course of the average *formes frustes* case is surprisingly calm. Most patients feel so well after the second or third day that it is difficult to persuade them to remain hospitalized. In a few cases, especially those with subphrenic involvement or a little more extravasation than the average, some fever is likely to persist 2 to 3 weeks before complete recovery ensues.

TREATMENT

If recognized within the first 24 hours, a patient with a perforation is as a rule operated upon immediately regardless of the severity or mildness of the symptoms. In the event that the patient is not seen until the second day, i.e., between the twenty-fourth and forty-eighth hours after perforation, surgical treatment is practiced unless the signs and symptoms point indubitably to a spontaneous closure and trifling leakage. If there is any question as to the perforation being sealed, operation is insisted upon. After the first 24 hours it generally is not difficult to decide whether the perforation is closed or not.

COMMENT

The recognition of the *formes frustes* perforation has aided us greatly in diagnosis, for since familiarizing ourselves with the clinical picture we have succeeded in recognizing a number of cases which we formerly should have misdiagnosed. These cases were erroneously considered as instances of acute gastritis, acute cholecystitis, acute pancreatitis, acute appendicitis, diaphragmatic pleurisy, central or abortive pneumonia, angina pectoris, coronary thrombosis, lead colic, tabetic crises, mesenteric thrombosis, and intestinal intermittent claudication. We do not wish to enter into a detailed discussion of the differential diagnosis at this time but merely desire to emphasize that the mistakes which are commonly made are the result usually of failure to consider or lack of familiarity with this mild type of perforated ulcer.

The view presented in regard to *formes frustes* perforations is not only of assistance in the diagnosis of hitherto obscure cases but also throws light upon the origin of a number of puzzling lesions. The assumption that these mild cases are of rather frequent occurrence explains some of the so-called cryptogenic intra-abdominal abscesses, especially the subphrenic and hepatic ones. A short while ago a patient was admitted to the hospital with symptoms and findings of a liver abscess for which no etiology was discovered even at postmortem examination until the history that the patient previously had had symptoms of a ruptured ulcer led to the search for evidence of a previous perforation and finally revealed it. Intra-abdominal adhesions not only local but also distant can be due to the

occurrence of a perforation with spontaneous closure. Extravasated gastric contents are readily disseminated over the entire abdomen and organization of the exudate can produce adhesions which may not cause trouble until years after the symptoms of a *formes frustes* perforation have been forgotten.

By discarding the textbook symptomatology of perforated ulcer and recognizing the *formes frustes* type, it is a simple matter to explain the spontaneous recovery of patients with a perforated viscus. It not infrequently happens that appendectomy is performed in the presence of an undiscovered perforated ulcer. The amputated appendix discloses healthy subserous structures and a periappendiceal inflammation which is part of the peritonitis caused by the gastroduodenal perforation. A number of these patients through the kindness of nature recover from the perforation and operation both and subsequently consult an internist for ulcer complaints. Not infrequently patients with diffuse peritonitis without any demonstrable point of origin are operated upon, the wound closed, or drainage applied without the site of origin being identified. Recently a patient was admitted to the hospital and operated upon for perforated ulcer but no perforation was found. From the history and subsequent course of events, the X-ray evidence of ulcer and perigastric adhesions, and the examination of the excised normal appendix, it seems probable that the peritonitis resulted from a perforated ulcer which became so completely sealed over by fibrin that the perforation escaped discovery at operation. The patient recovered completely after a rather stormy convalescence, so that the question as to the source of the peritonitis is now solely an academic one.

This conception of spontaneous plugging of the perforation furnishes a means of reconciling the extreme discrepancies among statistical reports from various clinics on the subject of perforated ulcer. If surgical intervention is instituted only in those cases in which the symptoms of peritonitis are severe and progressive the mortality in the cases seen after the first 24 hours will be quite high. This explains why Kuemmell, of Hamburg, was unable to save a single patient with perforated ulcer of more than 24 hours' duration. By declining to operate upon patients with widespread peritonitis and classifying them as inoperable or moribund, a surgeon can easily maintain a low operative mortality rate and still include in his series a considerable number of late cases. These late cases, however, would represent examples of the *formes frustes* type which probably would have gone on to recovery without operative intervention. When judging such statistics, therefore, it is important to know not only the time which elapses between the perforation and the operation but also to have complete knowledge of the extent and severity of the peritonitis at the time the surgeon intervenes.

Fig. 5. Case 1. Six days after Figure 1. Pneumoperitoneum has disappeared. Patient free from symptoms. Barium study 10 days later revealed duodenal ulcer.

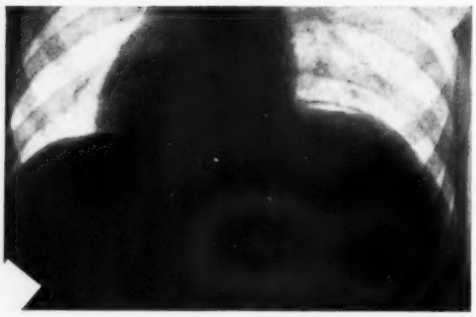

Fig. 6. Case 2. Pneumoperitoneum from perforated peptic ulcer 36 hours after perforation when patient entered hospital and was submitted to X-ray examination. Later examination with barium showed duodenal deformity. Recovery without operation.

SUMMARY

We have outlined a syndrome which permits the diagnosis of perforated peptic ulcers with only trifling leakage. The diagnosis is easy when spontaneous pneumoperitoneum is present and a little more difficult but still usually possible when free air is absent.

Many of these *formes frustes* cases heal spontaneously without operation but our experience with them is still too limited at the present time to justify positive conclusions as to operative indications.

What we wish to stress most is the surprising frequency of this condition and the use of the X-ray as an adjuvant in its diagnosis.

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PRIMARY CARCINOMA OF THE URETER

Report of a Case and a Review of the Literature

LOUIS M. ROUSSELOT, M.D., New York, and JOHN DANIEL LAMON, M.D., Macon, Georgia
From the Departments of Pathology and Surgery of the Presbyterian Hospital, and the Department of Pathology, College of Physicians and Surgeons, Columbia University, New York

UNUSUAL lesions often arouse the most interest and speculation. It is with this in mind that we are presenting the history of a case that proved to be a primary epithelial tumor of the ureter.

HISTORICAL

Carcinoma originating in the ureter is a rare condition. Rayer, in 1841, described the first case. The earliest report in the English literature did not appear until 43 years later (Davy). As late as 1926 Blatt could collect only 40 cases. Reviewing the available literature we have been able to find a few more reports so that our survey brings the total number of cases up to 49. To this we wish to add our case.

Mrs. M. M., History No. 70889, a 48-year-old negro housewife, was admitted to the Presbyterian Hospital February 4, 1928. Her chief complaint was pain in the left flank and left costovertebral angle of 6 weeks' duration. The family history was irrelevant. Patient had been married 32 years, had had 6 children and two miscarriages. Her general health had always been good. Eight years previously, she had had an attack of "gall-stone disease," manifested by right upper quadrant pain. For the past 2 years she had experienced dyspnœa on exertion. Symptoms referable to no other system were recalled by patient.

Six weeks before admission to the hospital she first noticed that she was becoming gradually weaker. About the same time she began to suffer from pain in the left flank and left costovertebral angle. At that time she went to bed, remaining there until her entrance to the hospital. The pain was constant from the onset except when relieved by medication. She felt feverish at intervals and had several drenching night sweats. Vomiting occurred on only three occasions, each time after taking medicine. Her bowels had been costive, requiring enemata. Nocturia proved a distressing feature from the beginning of her illness. Burning micturition was present for the 2 days prior to her visit to the hospital. The patient was certain that her abdomen had increased in size. No loss of weight could be ascertained.

Physical examination disclosed a well developed, obese negress, somewhat prostrated, feeble, and exhausted. Temperature was 101.2 degrees; pulse, 112; respiration, 32. The skin was warm and dry. The tongue had a thick white coat. Many teeth were missing, and those still present were carious. Lymph nodes showed no general enlargement. Examination of the lungs revealed dullness at the left base posteriorly; flatness in left midaxillary line, loud tubular breathing above and slightly posterior to the area of flatness. The right lung was clear and resonant. The heart was overacting; rate, rapid; apex not felt in prone position. On percussion the apex was 16 centimeters to left of midline in fifth interspace. No thrills or murmurs, and no arrhythmia were found. The sounds were loud and snapping. The second aortic sound was stronger than the second pulmonic. Blood pressure was 122–65. The abdomen was protuberant and the wall flabby. There was no evidence of fluid. Tenderness was present in the left flank, left costovertebral angle, and to lesser degree in the left upper quadrant. A large, hard, immovable mass could be palpated in the left upper quadrant. The liver and spleen were not felt. Rectal and pelvic examinations disclosed a large, round, smooth mass in the cul-de-sac.

Cystoscopic examination showed the floor of the bladder to be pushed up by a mass. This was interpreted as being an ovarian cyst.

X-ray examination of the abdomen gave evidence suggestive of stones in the left kidney; X-ray examination of the chest revealed a small amount of fluid at the left base. The right diaphragm had the appearance of a recent pleurisy, but nothing was seen which was suggestive of metastases.

Laboratory findings: Phenolsulphonephthalein test yielded 5 per cent excretion in two hours. Blood urea was 0.81 gram per liter; blood carbon dioxide was 29 volumes per cent. Red blood cells, 2,400,000; hæmoglobin, 55 per cent; white blood cells, 29,000. Differential count showed polymorphonuclear neutrophiles, 93 per cent; lymphocytes, 6 per cent; endotheliocytes, 1 per cent. Examination of the urine gave a specific gravity, 1.010; reaction, alkaline; sugar, none; albumin, heavy trace. Microscopic examination revealed the presence of pus.

Course. An exploratory laparotomy was performed one week after admission, and a large dermoid cyst of the left ovary was discovered. Removal of this mass was attempted but had to be abandoned because of the condition of the patient. The cyst, however, was opened and its contents evacuated to relieve pressure on the bladder and ureter. From the time of her admission and throughout the course of her illness, the patient had a septic temperature, varying between 99 degrees and 101 degrees F. She grew progressively weaker and died 31 days after

TABLE I.—RÉSUMÉ OF THE FORTY-NINE CASES COLLECTED FROM THE LITERATURE

Case and reference number	Sex	Age	Symptoms and signs	Association with calculus	Clinical diagnosis	Treatment and course	Pathology
1 (36)	F	58	Abdominal pain, several attacks of hæmaturia. No other symptoms or duration given	No			Autopsy: small pedunculated tumor nodules in rt. ureter, kidney calyces, bladder. Metastases in mesenteric nodes and liver. No microscopic examination reported.
2 (49)	F	41	Pain in rt. lumbar region and abdomen. Tumor palpated in rt. flank	No		No operation. Patient died 44 days after admission	Autopsy: tumor upper 12 cm. rt. ureter. Invasion rt. renal pelvis. Hydronephrosis, rt. kidney. Metastases in rectum, retroperitoneal nodes, peritoneum. Microscopic diagnosis: medullary carcinoma of rt. ureter.
3 (10)	M	53	Pain in l. loin and side and penis for 3 yr. Worse for 7 mo. prior to admission. Hæmaturia intermittent. Passed calculus 1 yr. before. Tumor palpated in left flank for 2 yr. Physical examination shows a fluctuant, non-tender immovable tumor in l. abdomen	Yes	Cyst involving l. kidney and ureter	(1) Nephrotomy; (2) nephrectomy. Died 2 mo. later	Surgical specimen: hydronephrosis, left. Autopsy: tumor lower 5 in. of l. ureter. Hydro-ureter, l. Calculus at site of tumor. Invasion of tumor into base of bladder and perforation into rectum. Metastases in lumbar nodes and liver. Microscopic diagnosis: encephaloid carcinoma of left ureter.
4 (47)	M	68	Hæmaturia, pain across loins, nausea, anorexia and wt. loss—4 mo. duration	No		No operation. Patient died about 7 wk. after admission	Autopsy: tumor lower 2 in. l. ureter. Hydro-ureter and hydronephrosis, l. Metastases in l. lumbar nodes, liver, lung. Microscopic diagnosis: villous carcinoma of l. ureter.
5 (38)	M	46	Fullness in rt. side of abdomen, increasing gradually and painlessly for 1 yr. Hæmaturia. Physical examination: weak and emaciated man. Fluctuating swelling, rt. lower abdomen. Urine: negative	No	Malignant disease suspected. Location not given	Fluctuant tumor tapped twice. No operation	Autopsy: tumor lower 3 in. of rt. ureter. Invasion of bladder wall, both vasa deferentia. Metastases in abdominal nodes, liver, and lungs. Hydro-ureter and hydronephrosis, rt. Microscopic examination: squamous cell carcinoma, rt. ureter.
6 (20)	M		No history given other than that patient died of a bilateral pneumonia	No		No operation. Died of pneumonia	Autopsy: tumor lower part l. ureter apparently originating from a diverticulum. Microscopic diagnosis: epithelioma of left ureter.
7 (16)	F	50	Increasing pain rt. lumbar region radiating to hip. Tumor rt. abdomen which seemed connected with rt. ilium	No	Osteosarcoma	Died	Autopsy: microscopic diagnosis: medullary carcinoma of rt. ureter.
8 (45)	F	89	Abdominal pain radiating to l. thigh. Constipation. Anorexia. No hæmaturia. Tumor size of child's head in l. side of abdomen	No	Tentative diagnosis: hydatid cyst; hydronephrosis	No operation. Patient died	Autopsy: tumor obliterating upper part of l. ureter. Tumor ureteropelvic junction. Hæmatonephrosis, l. Microscopic diagnosis: carcinoma of l. ureter.
9 (27)	F	66	No history given	No	Not mentioned in report	Not mentioned in report	Autopsy: tumor lower one-third of rt. ureter. Invasion of bladder and perforation of vaginal vault. Microscopic diagnosis: carcinoma of the rt. ureter with perforation into vaginal vault.

TABLE I.—Continued

Case and reference number	Sex	Age	Symptoms and signs	Association with calculus	Clinical diagnosis	Treatment and course	Pathology
10 (13)	M	67	Hæmaturia of 9 mo. duration. Polyuria and urgency of recent origin. Acute pain in rt. kidney region, often accompanied by pain in rt. hip. Physical examination: patient looked anæmic and had an icteric tint to his skin; findings otherwise unimportant	No	Malignant tumor of rt. ureteral orifice	Cystoscopy: negative 6 mo. previously but on last examination a tumor found in region of rt. ureteral orifice. Suprapubic cystotomy and fulguration of tumor mass. Patient died 15 days later	Autopsy: pigeon-egg size tumor of rt. ureteral orifice. Two small tumor nodules in rt. wall of bladder. Metastases in rt. kidney and lung. Extension of tumor into the prostate. Hydronephrosis, rt. Microscopic diagnosis: carcinoma of the rt. ureter.
11 (34)	M	41	Pain in l. kidney region accentuated during activity and relieved by rest. Attacks accompanied by hæmaturia—5 yr. duration, 4 yr. before admission to hospital fell and injured left hip and thigh. Immediately after suffered from radiating pain in l. kidney region. Associated with fever. Tumor size of a man's fist palpated in left flank	No	Tumor of left kidney	Cystoscopy: cystitis present. L. ureteral opening the site of tumor tissue. Nephro-ureterectomy: patient died 31 days after operation	Surgical specimen: left kidney not enlarged but pelvis dilated. Hydro-ureter. Multiple papillary growths in pelvis and ureter down to bladder.
12 (43)	M	69	Intermittent pain in back with recurrent hæmaturia of 6 mo. duration. Small palpable lump to the left of umbilicus	No	None reported	Not reported	Autopsy: tumor of l. ureter. Hydro-ureter and hydronephrosis, l. Metastases in retroperitoneal glands. Microscopic diagnosis: "cells of transitional epithelium."
13 (48)	F	60	Very severe intermittent pain in rt. side of abdomen. Large tumor the size of a child's head occupying almost the entire rt. abdominal cavity. Urine: few red blood cells and epithelial sediment	No	Calculus, cicatricial stenosis or neoplasm obstructing rt. ureter. Hydronephrosis, rt.	Cystoscopy: protruding mass obstructing rt. ureteral orifice. Nephro-ureterectomy: patient died 8 hrs. after operation with symptoms of embolus	Autopsy: tumor of rt. ureter. Hydro-ureter, hydronephrosis, rt. Metastases in retroperitoneal nodes, liver and lungs. Microscopic diagnosis: medullary carcinoma rt. ureteral orifice. Scirrhous carcinoma of middle of rt. ureter.
14 (26)	M	47	Recurrent attacks of renal colic over long period of years, with history suggestive of passage of stone on two occasions. One month before admission had severe cramp-like pain in center of abdomen, accompanied by nausea. Physical examination: marked muscle spasm over left kidney and loin. No masses felt. X-ray: negative	Yes	Calculus in left ureter	Cystoscopy: poor visualization due to hæmorrhage	Surgical specimen: tumor and stone lower end of l. ureter. Pyo-ureter, pyonephrosis, l. Microscopic diagnosis: adenocarcinoma of l. ureter.
15 (1)	M	69	Cutting pain in sacral region coming on suddenly 8 weeks before radiating to bladder and recurring at intervals. Urine varied from clear to cloudy. No dysuria; no urgency. Physical examination: tenderness in l. kidney region. Dark brown pigmented spots on lips and buccal mucosa. All other systems negative. Urine: cloudy; many white cells and epithelial cells; no red blood cells	No	Tuberculosis. "Tumor" of l. adrenal? Addison's disease?	No treatment reported. Patient died 1 mo. after admission	Autopsy: tumor lower left ureter. Hydro-ureter, hydronephrosis, l. Metastatic invasion of body of lumbar vertebra. Microscopic diagnosis: papillary and squamous cell carcinoma of l. ureter.
16 (50)	F	36	Hæmaturia, pain in lumbosacral region, radiating to bladder. Physical examination: mass in right kidney region.	No	Tumor of right kidney	Nephrotomy, removing large volume of chocolate colored fluid. Patient died	Autopsy: tumor middle third rt. ureter. Hydro-ureter; hydronephrosis, rt. Metastases in retroperitoneal glands. Microscopic diagnosis: squamous cell epithelioma of rt. ureter.
17 (37)	F	80	Pain in sacrum and right buttock, radiating to rt. leg; 3 mo. duration. Frequency and blood-tinged urine also complained of. Physical examination: negative. Urine: blood-tinged; many pus cells and red cells; also infrequent epithelial cells	No	Neoplasm of the urinary tract	No operation. No treatment reported. Patient died 14 days after admission	Autopsy: tumor of rt. ureter size of hazelnut and 3 cm. above ureteral opening. Hydro-ureter; hydronephrosis, rt. Metastasis in regional lymph node. Microscopic diagnosis: papillary carcinoma of rt. ureter.

TABLE I.—RÉSUMÉ OF THE FORTY-NINE CASES COLLECTED FROM THE LITERATURE—Continued

Case and reference number	Sex	Age	Symptoms and signs	Association with calculus	Clinical diagnosis	Treatment and course	Pathology
18 (32)	M	65	Recurrent attacks of pain in l. lumbar region for many years. Four mo. before admission suffered from pain in l. flank and bloody urine, onset of pain acute. Frequency and dysuria also complained of. Physical examination: large tumor in l. flank, fluctuant. Urine: blood-tinged	Yes	Malignant tumor of l. kidney pelvis. Hydronephrosis, l.	No operation. Patient died 4 days after admission	Autopsy: tumor lower one-third of l. ureter and the size of a lemon. Invasion of adjacent tissue. Metastases in l. kidney and retroperitoneal glands. Hydro-ureter and marked hydronephrosis, l. Microscopic diagnosis: papillary carcinoma of l. ureter.
19 (19)	F	60	Tearing, acute pain l. hypochondrium, radiating to l. breast, l. arm, l. thigh, of 10 yr. duration, occurring every 3–4 mo. Jaundice also often appeared. Hæmaturia and dysuria—duration not mentioned. Patient felt tumor in l. half of abdomen for 10 yr.	No	Hydronephrosis. Kidney tumor, l	Splenectomy. Nephrectomy. Died after operation.	Autopsy: tumor of l. ureter. Metastases in kidney. Splenomegaly (thought to be early Banti's disease). Microscopic diagnosis: papillary carcinoma of l. ureter.
20 (6)	M	53	Pain in hypogastrium, perineum, and scrotum—1 yr. duration. Nocturia 2x since onset of pain. Hæmaturia—5 weeks' duration. Physical examination: negative except for double varicocele	No	Neoplasm of l. ureter	Cystoscopy: blood from l. ureter. Obstruction to catheter 15 cm. up l. ureter. Function tests showed markedly diminished function of l. kidney. Nephro-ureterectomy. No follow-up reported	Surgical specimen: tumor size of olive in upper part of l. ureter. Second nodule 3 cm. lower. Hydro-ureter. Hydronephrosis, l. No nodes felt at operation. Microscopic diagnosis: epithelioma of l. ureter.
21 (5)	M	53	Hæmaturia 19 mo. previously. Several similar attacks in interim. Incontinence of urine 7 mo. before admission. Severe constant pain in rt. sacro-iliac region described as "sciatica." This had its onset 5 mo. previously. 51-lb. weight loss since onset. Physical examination: firm, round, non-tender tumor to rt. of umbilicus and fixed to posterior abdominal wall. Rt. testicle 3–4 times the size of l. Tenderness over rt. sacro-iliac region.	No	Sarcoma of rt. ileum	Cystoscopy: obstruction in rt. ureter 6 cm. from bladder. Biopsy of tumor tissue. Patient then given glandular therapy. Died 39 days after operation and 70 days after admission	Autopsy: tumor obliterating central half of rt. ureter. Extension into psoas and iliacus muscles, posterior peritoneum and lumbar plexus. Microscopic diagnosis: squamous cell carcinoma of rt. ureter.
22 (7)	F	54	Hæmaturia 3 mo. before entrance to clinic. Recurred once. Some weight loss. Physical examination: negative. Urine: several red and white cells	No	Tumor of l. kidney, kidney pelvis or l. ureter	Cystoscopy: catheter met a resistance 8 cm. up l. ureter. No urine and only a little blood from l. ureter. No return of dye from l. ureter during function test. Nephro-ureterectomy. Patient well 1 year after operation	Surgical specimen: tumor of midportion of l. ureter the size of a cherry. Extension into surrounding tissue. Hydro-ureter, l. Microscopic diagnosis: papillary carcinoma of l. ureter.
23 (41)	F	41	Pain in loins of 3 weeks' duration. Appeared suddenly at menstrual period. Pain also in hips, hypogastrium and rt. thigh. Physical examination: did not answer questions. Refused all food. Apathetic. Temperature subnormal	No	Sciatica. Dementia præcox	No treatment reported. In hospital 2 days on second admission and then died	Autopsy: tumor lower end rt. ureter. Metastases in regional and mesenteric nodes and psoas muscle. Hydro-ureter; hydronephrosis, rt. Microscopic diagnosis: carcinoma solidum simplex.
24 (12)	M	35	Hæmaturia 4 yr. previously and again shortly before admission. No other signs or symptoms reported	No	Papilloma of bladder	Partial ureterectomy at site of tumor. Secondary hæmorrhage 12 days postoperative. Smooth recovery	Surgical specimen: papillomatous tumor of l. ureter. Hydro-ureter, l.; hydronephrosis not mentioned. Microscopic diagnosis: beginning malignant degeneration of a papilloma of the ureter.
25 (30)	F	08	Mild hæmaturia 2 mo. duration, accompanied by frequency but no pain. Physical examination: no masses on abdominal palpation. Second admission: 2 yr. later. Recurrence of hæmaturia. Mass palpated in rt. upper quadrant, firm, freely movable	No	Malignancy of rt. ureter suspected	Cystoscopy: ureteral catheterization and drainage of rt. hydronephrosis. Catheter met obstruction 15 cm. up rt. side. No bleeding followed. Patient discharged but returned 2 yr. later with recurrent hæmaturia and mass in rt. costal region. Cystoscopy: 2 yr. later. Papillary tumor projecting from rt. ureter. Nephro-ureterectomy. Patient died in uræmia 1 mo. after operation	Surgical specimen: tumor of rt. lower ureter. Hydro-ureter rt.; hæmatonephrosis, rt. Microscopic diagnosis: papillary carcinoma of rt. ureter with metastases to retroperitoneal lymph nodes.

TABLE I.—Continued

Case and reference number	Sex	Age	Symptoms and signs	Association with calculus	Clinical diagnosis	Treatment and course	Pathology
26 (17)	M	35	Several attacks of hæmaturia over a period of 4 yr. Loss of weight. Urine contained a moderate amount of blood	No		Cystoscopy: papillary tumor covering the ureteral orifice. Suprapubic cystotomy. Resection of 10 cm. of ureter. Lower end of ureter implanted in bladder wall. Patient well at end of 1 month	Surgical specimen: tumor of ureter, size of pigeon's egg. Microscopic diagnosis: papilloma with incipient malignant changes.
27 (46)	F	46	Pain in rt. side as long as she can remember. Accompanied by frequency. Attacks of pain more frequent the past year, and associated with fever, vomiting, and hæmaturia. Rt. side kidney operation at 16 (indication not given). Physical examination: rt. kidney the size of a child's head. Tenderness over rt. kidney. Urine: cloudy; many pus cells	No	Pyonephrosis	Cystoscopy: rt. ureteral orifice reddened. Urine cloudy and came slowly from rt. ureter. No obstruction in either ureter to catheter. Nephrectomy. Second stage a ureterectomy 5 mo. later. Patient well after 4 weeks. No follow-up	Surgical specimen: tumor in midportion of rt. ureter. Pyo-ureter; pyonephrosis. Microscopic diagnosis: papillary carcinoma of rt. ureter.
28 (40)	F	55	Diffuse abdominal pains and pains in l. lower quadrant for 5 wk. Vomiting about same time, followed by headache. Constipated for past 9 mo. Physical examination: pain and tenderness in l. inguinal region. Marked anæmia. Urine: hyaline and granular casts	No	Intestinal obstruction. Tuberculous peritonitis	Operative procedure not mentioned. Patient died 12 days after admission	Autopsy: tumor upper end of l. ureter. Extension into kidney. Invasion of psoas muscle and vertebræ. Metastases in liver, l. kidney and vertebræ. Pyonephrosis, l. Microscopic diagnosis: transitional cell carcinoma of the l. ureter.
29 (23)	M	73	No history given except that patient died of cardiac and renal insufficiency	No			Autopsy: rt. kidney "beginning malignant sclerosis." L. kidney, hydronephrotic sac. L. ureter halfway down, small, knotty excrescences reminding one of tuberculosis. Proximal end of l. ureter widened and filled with cheesy material. Microscopic diagnosis: papillary carcinoma of l. ureter.
30 (33)	F	55	Pain in rt. kidney region of 2 yr. duration and associated with fever; urgency experienced during 6 mo. previous to admission to hospital. Dysuria and frequency for last 4 mo., also bloody, cloudy urine. Patient noticed tumor in rt. side of abdomen during latter part of her illness. Physical examination: small, weak, emaciated woman. General enteroptosis; a well outlined ballotable tumor the size of a fist in the region of the rt. kidney. A second smaller mass also palpable below and medial to first. Urine: cloudy; contained pus and red cells	No	Tumor of right kidney	Cystoscopy: tumor in region of rt. ureter and of papillary structure. Nephro-ureterectomy; excision of involved bladder mucosa about rt. ureteral opening. No follow-up reported	Surgical specimen: tumor in rt. ureter, 1 cm. above vesical opening and extending 1.5 cm. upwards with obstruction of lumen. Mass had a papillary structure. Also hydro-ureter and hydronephrosis, rt. Microscopic diagnosis: papillary carcinoma of the rt. ureter.
31 (21)	M	48	Hæmaturia of 2 yr. duration. Pain in head of penis at end of micturition. X-ray showed a suspicious shadow in the region of the lower l. ureter	Yes	L. ureteral neoplasm; or l. renal neoplasm withobstruction at the l. meatus	Cystoscopy: bloody urine from l. ureter. Obstruction of same meatus by neoplasm and stone. Nephrectomy; ureterectomy and resection of an area of bladder wall were carried out 11 days after first operation. Patient discharged 1 mo. later in good condition	Surgical specimen: papillary tumor 8 cm. in diameter involving the lower l. ureter. Pyonephrosis, l.; pyo-ureter, l. Microscopic diagnosis: papillary epithelioma of l. ureter.
32 (44)	M	65	Pain in l. kidney region of 6 mo. duration. Hæmaturia for 8 days preceding admission to hospital			Cystoscopy: congestion about l. ureteral orifice. Obstruction 8 cm. above the orifice. Nephrectomy: then secondary operation. (Ureterectomy attempted but procedure abandoned due to pressure of a large mass over iliac vessels.) Patient died 9 days after operation	Hydro-ureter. Tumor mass over the l. iliac vessels.

TABLE I.—RÉSUMÉ OF THE FORTY-NINE CASES COLLECTED FROM THE LITERATURE—Continued

Case and reference number	Sex	Age	Symptoms and signs	Association with calculus	Clinical diagnosis	Treatment and course	Pathology
33 (45)	F	64	Pain in rt. side for 2½ yr. of great severity the last 2 mo. Hæmaturia 1 mo. before admission. Physical examination: mass in rt. side of abdomen the size of two fists			Cystoscopy: catheter in rt. ureter met an obstruction 5 cm. above the ureteral orifice. Nephrectomy and later a ureterectomy were performed. Patient was still well 1 yr. after the operation	Surgical specimen: tumor of rt. ureter, hydro-ureter rt., hydronephrosis, rt. Microscopic diagnosis: solid carcinoma of the rt. ureter.
34 (3)	M	38	Stabbing pain in rt. flank radiating down course of ureter, of 3 wk. duration. Accompanied by vomiting, chills and temperature of 105 degrees. After 5 days the pain subsided. Patient thought he had passed a stone. Hæmaturia associated with latter event. A dull, constant rt. upper abdominal pain persisted until admission. X-ray: calculi in rt. kidney	Yes	Renal calculi	Cystoscopy: catheterization of both ureters accomplished without difficulty. Nephrotomy and removal of stones carried out. A mass was felt at the ureteropelvic junction which on section proved to be carcinoma. 2nd operation. Nephro-ureterectomy	Surgical specimen: tumor of rt. ureter, hydronephrosis, rt. Microscopic examination: squamous cell carcinoma.
35 (25)	M	49	Pain in the rt. hip, radiating to the rt. inguinal region, of 4 mo. duration. Physical examination: slight resistance in hypogastrium —a cord-like structure was made out along the course of the rt. ureter (on second admission)	No	Malignancy of rt. ureter	Cystoscopy: the ureteral catheter passed up only to the level of the 2nd sacral segment on the rt. side. Patient died before operation	Autopsy: carcinoma of rt. ureter. Metastases in liver, lungs, pericardium, spleen, pancreas, l. kidney, lymph nodes. Hydronephrosis, rt. Microscopic diagnosis: papillary epithelioma of rt. ureter.
36 (24)	M	74	Hæmaturia of 5 wk. duration. Urine never free of blood since onset. Weight loss of 10 lbs. Physical examination: negative	No	Tumor of l. kidney. Hydronephrosis	Cystoscopy showed distortion of l. ureter. No obstruction. Continued to pass blood after the operation	Surgical specimen: hydronephrosis, l. Tumor of l. ureter. Microscopic diagnosis: papillary carcinoma of l ureter.
37 (8)	F	42	Hæmaturia and blood clots in urine about every 3 wk. for past year. Occasionally associated with frequency and urgency. Severe pain in bladder region for first time on day before admission, accompanied by urgency, frequency, and bloody urine. Physical examination: patient pale and thin. Rt. kidney enlarged; moderately tender on palpation; tenderness down course of ureter. Urine: few red cells. X-ray negative	No	Ureteral obstruction "probably tumor." Hydroureter. Hydronephrosis	Cystoscopy: bladder and both ureteral orifices normal. Catheter stopped 7 cm. up rt. ureter. Bleeding from same side. Rt. kidney returned no dye. Ureteropyelogram: dilatation of ureter above obstruction. Ureteronephrectomy: uneventful recovery. Patient still well 2½ yr. after the operation	Surgical specimen: hydroureter and hydronephrosis, rt. Tumor of rt. ureter. Microscopic diagnosis: "mucous membrane epithelioma (carcinoma)."
38 (29)	F	69	Pain in the lumbar region; frequency and hæmaturia were first noticed 5 mo. before admission. These symptoms recurred with increased severity 2 mo. later. The pain did not radiate, became constant, and was aggravated by motion. A considerable loss of weight was observed. The patient noticed a mass in the rt. flank 6 wk. before admission. Physical examination: slightly enlarged liver. Rt. kidney also enlarged. Smaller mass felt in the region of the rt. lower ureter. Laboratory findings: Blood—N.P.N. 40.4 mgs. 100 c. cm. Urea 17.8 mgs. 100 c. cm. Creatinin 1.3 mgs. 100 c. cm. Phenolsulphonephthalein test—15 per cent from rt. kidney in 15 min. No return from left kidney. X-ray: rt. kidney shadow not plainly visible. A vague shadow was seen in the lower ureteral region. The 11th and 12th dorsal vertebræ showed increased density and blurring of the normal markings	No	Malignancy of the upper urinary tract with secondary implantation in the lower ureter and hydronephrosis	Cystoscopy: in the rt. ureter, an obstruction was encountered 4 cm. from the bladder. No urine from this side but blood trickled down alongside the catheter. L. ureter normal. Ureteronephrectomy: The patient died 8 mo. later of metastases	Surgical specimen: tumor of rt. lower ureter. Hydronephrosis, rt. Microscopic diagnosis: carcinoma of the ureter.

TABLE I.—Continued

Case and reference number	Sex	Age	Symptoms and signs	Association with calculus	Clinical diagnosis	Treatment and course	Pathology
39 (31)	M	57	Pain in rt. para-umbilical region, radiating along course of rt. ureter of 2 mo. duration. Also dysuria and pain in rt. testis. Total hæmaturia not influenced by movement. Loss of 2 kilos of weight in 2 mo. Previous history: prostatitis 10 yr. before. Physical examination: tenderness and spasm in rt. para-umbilical region. No mass felt. Rt. varicocele. Urine: : loudy in 3 glasses. No hæmaturia at this examination. X-ray showed slightly enlarged rt. kidney. No stones	No	Probable neoplasm of upper ⅓ of rt. ureter	Cystoscopy: injection of mucosa about rt. ureteral orifice. Catheter stopped ⅗ the way up rt. ureter. Followed by bleeding. Pyelotomy: pelvis normal. Resection of 4 cm. of ureter in region of tumor. Kidney not removed. Oliguria for 4 dy. Patient well 20 dy. after operation. No hæmaturia	Surgical specimen: tumor 2 cm. long in upper part of rt. ureter. Mass hard, size of a little nut and adherent to surrounding tissue. Microscopic diagnosis: cylindrical cell epithelioma.
40 (11)	F	54	Hæmaturia 6 mo. before admission lasting for 2 days and then disappearing. Recurrence of hæmaturia with addition of pain in rt. side 3 mo. later. A mass gradually developed which could be felt anteriorly below the costal margin	No		Cystoscopy: catheter met an obstruction 4 cm. above orifice. Nephrectomy and partial ureterectomy. Uneventful recovery	Surgical specimen: a papillomatous tumor of the rt. ureter, hydronephrosis, rt. Microscopic diagnosis: papillary carcinoma of the rt. ureter.
41 (51)	M	70					Autopsy: walnut-sized tumor of the l. ureter at the level of the linea arcuata. Extensive perinephritic abscess behind l. kidney.
42 (35)	F	66	Hæmaturia and "trouble" in bladder of 8 mo. duration. Passed pure blood shortly before admission. Physical examination: patient did not look sick. Heart: systolic blow at apex. Œdema in region of both malleoli; otherwise negative examination. Urine: many red cells	No	Stenosing carcinoma of rt. ureter with hydronephrosis	Cystoscopy: cherry-sized tumor in rt. ureteral orifice. Tumor cauterized. Nephrectomy and partial ureterectomy 53 dy. after admission. Ureterectomy and resection of portion of bladder wall 41 dy. after first operation. Cystoscopy 26 dy. later showed good bladder scar and no evidence of tumor	Surgical specimen: tumor filling two-thirds of rt. ureter and projecting from orifice. Hydroureter, rt., hydronephrosis, rt. Microscopic diagnosis: papillary carcinoma of rt. ureter.
43 (42)	F	75	Pain on rt. side and hæmaturia of 8 mo. duration. Pain occasionally radiated to rt. groin. Intermittent frequency. Malaise and some slight weight loss also described. Physical examination: feeble old woman. Abdomen: ..o renal enlargement. Tenderness on deep palpation in rt. hypochondriac and rt. lumbar regions. Liver not enlarged. No ascites. Urine: faint trace albumin. No red cells	No	Tumor of rt. ureter, probably primary in renal pelvis though possibly primarily situated in ureter	Cystoscopy: bullous œdema and congestion around rt. ureteral orifice. Catheter arrested 15 cm. up rt. ureter and small amount of bloody secretion obtained. L. ureter normal. Many red cells in urine from rt. side. Ureteropyelogram: obstruction in rt. ureter. Nephrectomy and partial ureterectomy. Patient felt well at end of 3 wk.	Surgical specimen: sessile papillary tumor covering three-quarters of wall of rt. ureter and 3 cm. in length. Slight dilatation of ureter above tumor but upper 6 cm. of ureter was normal. Rt. kidney normal. Microscopic diagnosis: primary papillary epithelial tumor of the rt. ureter with cyst formation.
44 (15)	F	49	Hæmaturia for 1 mo. before admission. Associated with pain in left side and dysuria. Physical examination: tenderness in left flank; otherwise negative. X-ray: stones in l. kidney region. Enlarged l. kidney	Yes	None reported	Cystoscopy: hyperæmia about l. ureteral orifice. Catheter stopped about 10 cm. up ureter. No dye return on left. Nephrectomy and ureterectomy: no follow-up of case reported	Surgical specimen: tumor of l. ureter 4–5 cm. long at level of linea innominata. Dilated ureter proximal to and normal ureter distal to mass. Hæmatopyonephrosis, l. Extension of tumor into retroperitoneal fat. Two enlarged nymph nodes. Miscroscopic diagnosis: medullary carcinoma of the l. ureter.
45 (14)	F	71	"Sciatica" for 1 yr. Pain in rt. and l. hypogastric regions. Anuria for 3 days unrelieved by her doctor so came to hospital. Physical examination: sick, emaciated old woman, B.P. 240. Ringing second aortic sound; enlarged, tender rt. kidney; l. also enlarged, though less tender	No	None reported	Cystoscopy: catheter met an obstruction 1 cm. up left ureter. Catheter passed halfway up rt. ureter with return of small amount of concentrated urine. No dye return. No operation. Diuretics did not relieve anuria. On third day developed fluid in both chests. Tapped repeatedly. Died on 14th day in hospital	Autopsy: tumor 5 cm. in diameter in mid-third of l. ureter. Hydro-ureter, l., hydronephrosis, l., chronic nephritis, pyelonephritis, rt., hydroureter, rt. Microscopic diagnosis: carcinoma of l. ureter.

TABLE I.—RÉSUMÉ OF THE FORTY-NINE CASES COLLECTED FROM THE LITERATURE—Continued

Case and reference number	Sex	Age	Symptoms and signs	Association with calculus	Clinical diagnosis	Treatment and course	Pathology
45 (31)	M	55	Pain in loins, especially in rt., and hæmaturia for 1 yr. and 3 mo. Rt. kidney removed 15 mo. previously. Bleeding stopped for a month. However, hæmaturia returned together with pain in rt. lower abdomen, radiating to rt. thigh and perineal regions. Physical examination: tenderness in region of rt. ureter and rt. side of bladder. A cord-like nodular enlargement was palpated along course of rt. ureter	No	Tumor of rt. ureter. Undecided as to whether it was malignant or benign until operation	Cystoscopy: 15 mo. before showed bleeding from rt. ureter. Diagnosis of kidney tumor was made and nephrectomy performed. Cystoscopy (on last admission): papillary growth emerging from rt. ureter. Could not with surety be called carcinoma. Ureterectomy then performed. Patient died at home several months later	Surgical specimen: tumor of lower potion of rt. ureter. Microscopic diagnosis: medullary carcinoma of rt. ureter.
46 (22)	M	54	Pain in lumbar region first noted 3 yr. before admission. Had recurrence of pain 1 yr. later, and lasting for 2 wk. Cystoscopy at that time was negative. 2 mo. before admission he again began to have lower back pain and began to lose weight and strength. He passed blood clots 1 mo. previous to his appearance at the hospital	No	Papillary epithelioma of rt. ureter	Cystoscopy: 1st admission was negative. Cystoscopy: 2nd and 3rd admissions showed that small amount of material removed from rt. ureteral orifice proved to be papillary epithelioma. Prostatectomy: 3 mo. later following continuance of pain and hæmaturia, a nephro-ureterectomy was performed. Recurrence of tumor in bladder. Continuation of pain in rt. hip region	Surgical specimen: small papillomatous tumor low down in rt. ureter. Microscopic diagnosis: papillary epithelioma of rt. ureter.
47 (39)	F	61	Painless hæmaturia occurring at intervals, and of 6 mo. duration. Hæmaturia continuous for 6 wk. before admission. Patient was a diabetic and treated for such before onset of last illness. X-ray: opaque solution in ureter gave evidence of obstruction on left side	No	Tumor of ureter	Cystoscopy: bleeding from l. ureter. No return of dye on l. Catheter stopped 15 cm. up l. ureter. Nephrectomy and ureterectomy. Following operation patient went into a state of coma and died on the 2nd day	Surgical specimen: egg-shaped tumor of l. ureter measuring 4 by 3 by 1 cm. This was located at point of crossing of ureter and iliac vessels. Extension of tumor into adjacent tissue was apparent. Hydro-ureter, l., hydronephrosis, l. Microscopic diagnosis: a solid richly cellular carcinoma.
48 (18)	M	61	Hæmaturia 1 yr. before admission. Irritability of bladder only other symptom	No	Papillary epithelioma of lower ⅓ of rt. ureter	Nephro-ureterectomy: Uneventful postoperative course	Surgical specimen: tumor of rt. ureter. Hydro-ureter, rt., hydronephrosis, rt. Microscopic diagnosis: papillary epithelioma of rt. ureter.

admission. The clinical diagnosis was (1) dermoid cyst of the left ovary; (2) nephrolithiasis (left); (3) pyonephrosis (left); (4) cystitis.

Necropsy findings. Only the essential findings are presented. When the peritoneal cavity was opened a small amount of a thin, blood-tinged fluid welled up into the wound. The hollow viscera and omentum were bound to the anterior abdominal wall, beneath the region of the surgical incision, by dense fibrous adhesions. The serosal surface of all the viscera was smooth and glistening. Examination of the pelvis revealed a large round tumor mass, that measured 10 centimeters at its broadest point, and that filled the pouch of Douglas. This extended slightly above the pelvic brim and adherent to its upper surface was a loop of ileum. A pale pinkish-blue capsule covered the mass. It occupied the site of the left ovary, had a doughy consistency and was firmly bound to adjacent structures by fibrous adhesions. This mass proved to be a cyst partially filled with a thick, greenish-yellow, pultaceous material interspersed with fine strands of white hair. Both fallopian tubes were firmly fixed by fibrous adhesions. The right ovary, together with the uterus, cervix, and vagina, were normal. The *left ureter* was slightly dilated, measuring 0.5 centimeter in diameter. Beginning at the outlet of the *left kidney pelvis* and extending 5.5 centimeters down the ureter were seen numerous small, irregular, elevated, opaque, greyish patches of tumor tissue. These formed discrete islands with intervening portions of mucosa (Fig. 1). This growth extended almost through to the fibrous coat. In the mucosa of the mid-third of the ureter were several small, translucent, elevated cysts (Fig. 1). The kidney was enlarged, measuring 17 by 13 by 10 centimeters. It presented a bosselated surface. The renal pelvis was little else than a large multiloculated cavity filled with thick, purulent fluid. Adjacent to this, the kidney parenchyma was found compressed against the capsule. Two large yellowish-brown stones with finger-like projections formed a cast of the calyces of the upper and lower poles respectively (Figs. 1 and 1a).

The *right ureter* was markedly dilated, measuring 2 centimeters in diameter. In its midportion were numerous small cysts similar to those seen in the

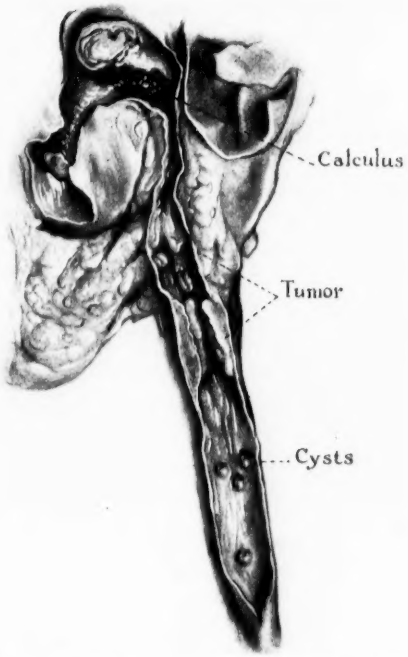

Fig. 1. Drawing of field outlined above showing primary tumor in upper part of ureter.

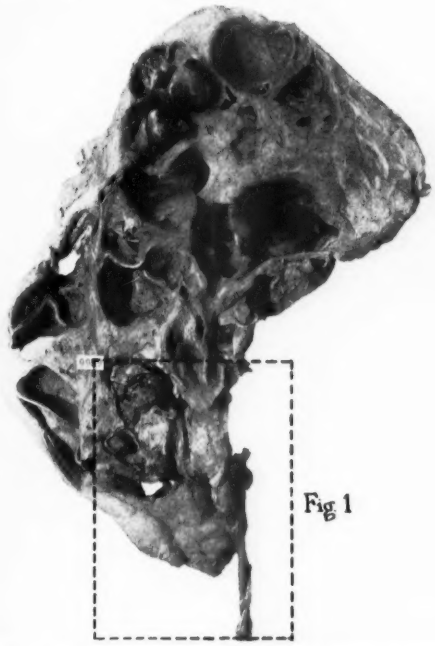

Fig. 1a. Pyonephrotic left kidney with calculi in upper and lower calyces.

left ureter. One centimeter from the ureterovesical opening, a long pointed stone was found completely occluding the lumen. The *right kidney* measured 16 by 10 by 9 centimeters. Its pelvis and calyces were extremely dilated and the pyramids flattened. No calculi were present in this organ.

The bladder was small and thick walled. Its mucosa, particularly in the trigonal region, was intensely injected, but not covered by exudate. Injection of the urethral mucosa was also apparent.

The tumor invaded the left kidney and adjacent nerves. Metastatic tumor nodules were present in the regional, perigastric, and bronchial lymph nodes, also in the adrenals, pancreas, liver, lungs, and pleuræ.

Histological examination of the material from the primary site showed the ureteral mucosa to be completely replaced by tumor. The tumor cells were squamous in type with basophilic cytoplasm and large hyperchromatic vesicular nuclei. Prickle cells were found in many areas. Mitotic figures were not abundant. The tumor cells were often arranged in rounded islands or formed long finger-like processes that dipped down into the subjacent muscularis. The stroma was moderate in amount and consisted of a loosely arranged collagen tissue with few vessels and small agglomerations of lymphocytes and eosinophiles (Figs. 2 and 3). The metastatic tumor growths had a cellular morphology similar to the parent tumor (Fig. 4).

Among the interesting findings in this case were the small ureteral cysts previously mentioned. Microscopic study of these structures showed them to be lined with a single layer of flattened or cuboidal epithelium and filled with a pink-staining granular or homogeneous material. A thin hyaline lining was often adherent to the inner wall of the cyst (Fig. 5). Islands of epithelial cells were often found beneath these structures. Morse recently gave a comprehensive though terse discussion of this condition—ureteritis cystica.

The ovarian cyst was lined with a layer of squamous epithelium. Desquamation of the corneal layer was seen in many places. A broad, dense band of fairly vascular fibrous tissue formed the layer adjacent to the epithelium. A few small collections of lymphocytes were strewn through the connective tissue coat. No changes of a malignant character were found anywhere in this cyst.

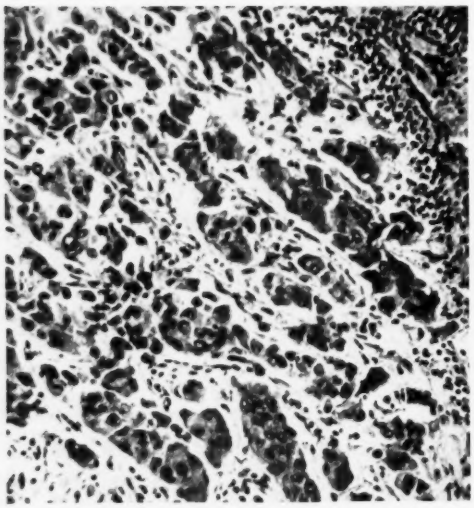

Fig. 2. Squamous cell carcinoma at primary site in left ureter. ×160.

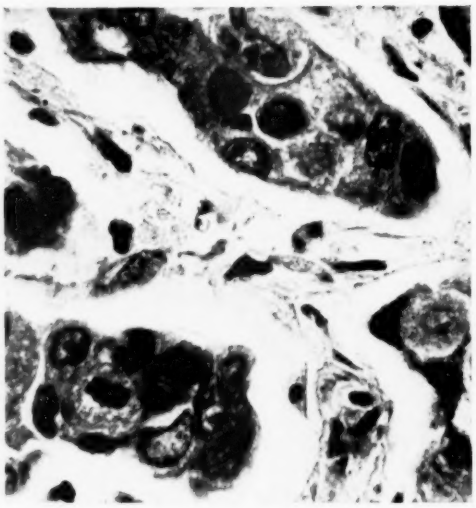

Fig. 3. High power of Figure 2 showing detailed cellular morphology. ×720.

The sequence of lesions in this case was interpreted as follows: As a result of repeated pregnancies or the presence of the large dermoid cyst, there occurred a bilateral hydronephrosis, then infection and calculus formation. In the left ureter, a squamous cell carcinoma developed that metastasized to the situations already mentioned. In addition to the carcinoma and dermoid cyst, a diffuse adenomyomatosis of the left fallopian tube was found following the routine section of this appendage. The patient, therefore, presented three distinct types of neoplasms.

INCIDENCE

Carcinoma of the ureter occurs in both sexes with about the same frequency. In this group there were 25 males and 24 females affected. The age limits varied from 35 years to 89 years with the frequency increasing in the later decades. Over 60 per cent of this series occurred in individuals above 50 years of age.

SYMPTOMATOLOGY

Pain and hæmaturia are the symptoms that stand out with startling constancy throughout all these histories. One or the other was complained of in every instance and both were present in over 50 per cent of the cases. The pain was usually referred to some region along the course of the urinary tract. Adjectives descriptive of its character were varied—sharp, colic-like, cutting, stabbing, tearing, all found their place in the patients' stories. The pain often radiated along the course of the ureter, simulating the clinical picture of renal calculus, so that this diagnosis was made in some instances. Other symptoms, such as urgency, frequency, dysuria, nocturia, incontinence, anorexia, vomiting, chills, loss of weight, and the sensation of a mass were repeated in only a few cases.

DIAGNOSIS

The recognition of this lesion is seldom accomplished. In only 14 of these cases was a diagnosis of tumor of the ureter made or even the condition suspected before operation or before necropsy. Tumor of the kidney or renal stone were the two conditions most frequently confused with this disease. A history of hæmaturia and pain, the finding of a ureteral obstruction on catheterization, and X-ray films negative for stones, are strongly suggestive of a growth in the ureter. It is probably impossible to give a positive opinion

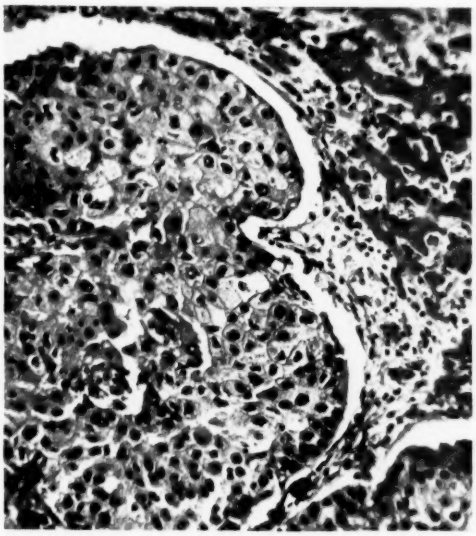

Fig. 4. Cell type of primary tumor reproduced in metastatic liver nodule. ×160.

Fig. 5. Cysts in ureteral mucosa distal to tumor (ureteritis cystica). ×160.

of the nature of the growth at this stage. Increasing weakness and weight loss are ominous signs that help to establish the malignant character of the process. An associated hydronephrosis may aid in centering the attention on a lesion distal to the kidney.

PATHOLOGY

The most common type of ureteral carcinoma is the so-called papillary carcinoma. On gross examination, as the name implies, it presents a surface with papillary or villous projections. Histologically these tumor cells closely resemble those of transitional epithelium and have the irregularity of outline, mitotic figures, and invasive qualities which distinguish any malignant growth.

Other forms of ureteral carcinoma are less frequent and may be grouped for the sake of convenience as non-papillary carcinomata. These include the squamous cell type, the adenocarcinoma, and the medullary or solid carcinoma. As with other neoplasms, the nomenclature is dependent on the individual describing the case. Our case proved to be a squamous cell carcinoma. Only five other such tumors are found in the literature.

Metaplasia of the epithelium of the kidney pelvis and ureter, from the transitional to the squamous form, is not an uncommon occurrence, particularly in the presence of stones. The natural inference is that these squamous cell tumors follow such metaplasia.

The irritative action of stones as a causative factor in renal tract tumors is a theory advanced by many. Albarran, in a review of 53 cases of benign and malignant epithelial tumors of the renal pelvis and ureter, found stones present in eight instances and believed that they played a rôle in the development of these tumors. We are unable to reach a similar conclusion. In the case reported here a calculus was found immediately adjacent to the primary growth. On the other hand, in only 6 of the collected cases were stones present anywhere along the urinary tract. One of the sequelæ of prolonged ureteral obstruction is hydronephrosis. The palpation of a large hydronephrotic sac has frequently proved misleading in that a diagnosis of such a condition has been made, ignoring the possibilities of a lesion lower down in the urinary tract.

TREATMENT AND PROGNOSIS

The prognosis in these cases is exceedingly grave. From the previous table, it will be

noted that 30 patients died while under treatment or within a few months after leaving the hospital. Of the remaining 19, the longest followed patient was that of Crance and Knickerbocker (9), their patient being well after 2½ years. Two authors (Chiari, Suter) reported symptom-free periods of one year in each of their respective cases. All the other reports gave very short periods of well-being or concluded the case with some non-committal expression as "uneventful recovery." As to treatment, the procedure of choice is ureteronephrectomy, preferably via the lumbar route.

SUMMARY

Primary carcinoma of the ureter is a rare lesion. Previous to the case reported here, only 49 cases have been recorded in the literature. The most common type of carcinoma is the so-called papillary epithelioma. Less frequent is the squamous cell tumor of which the present case is an example. Ureteral carcinomata metastasize widely, traveling by venous and lymphatic channels. Renal calculi are occasionally associated with this neoplasm. Many authors believe that stones, by their irritative action, are an important causative factor in the production of epithelial tumors of the genito-urinary tract. In the cases here reviewed, no frequent association of stones and tumor could be discovered. The two most constant symptoms of this disease are pain and hæmaturia. The condition is rarely diagnosed before operation or necropsy. X-ray and cystoscopic examinations are the most important diagnostic aids. Removal of the affected ureter and kidney is the treatment of choice. The course of the disease, following any form of treatment, has been discouraging. In only one recorded case was the patient symptom-free 2½ years after being first observed.

We wish to express our appreciation to Dr. W. C. von Glahn and Dr. F. B. St. John for their help in assembling this paper and to Dr. J. Jobling and Dr. A. O. Whipple for the use of their records.

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RIGHT PARADUODENAL HERNIA AND ISOLATED HYPERPLASTIC TUBERCULOUS OBSTRUCTION

Comment and Report of Case Affecting Jejunum and Ileum; Operation and Recovery[1]

JAMES C. MASSON, M.D. (Tor.), F.A.C.S., and ARCHIBALD H. McINDOE, M.B., Ch.B. (N.Z.), M.S. (Path.),
Rochester, Minnesota
Division of Surgery, The Mayo Clinic

BOTH right paraduodenal hernia and hyperplastic tuberculosis of the jejunum and ileum are exceedingly uncommon. The first never has been diagnosed clinically and the second in such a situation has been described only occasionally. Their association in the same lesion, therefore, appears to be unique, and for this reason they will be discussed separately before an attempt is made to correlate them.

REPORT OF CASE

The patient, a male Sioux Indian, aged 41 years, first came to The Mayo Clinic 5 months prior to operation, complaining of somewhat vague stomach trouble. Twelve years previously he had had a gastro-intestinal upset associated with urticaria following a meal of canned corn. From then on he had suffered from mild intermittent attacks of epigastric pain which had come usually during harvest time and had occurred 2 to 5 hours after meals. These attacks had been associated with considerable bloating and belching and occasional attacks of vomiting. He had noticed that rough foods were particularly likely to precipitate them. He stated that during the attacks a balloon-like mass seemed to appear in the right upper abdominal quadrant and that after some time it disappeared, with considerable intestinal gurgling. He was not constipated, had never been jaundiced, and his appetite was good. For 3 months prior to admission to the clinic, the attacks had become somewhat more severe and he had lost 15 pounds.

On examination the patient appeared to be in good general condition except for some loss of weight. The only observation of note, objectively, was that intestinal borborygmi were somewhat prominent, and that an occasional distended loop of intestine could be felt. Definite masses or organs could not be palpated, and at this time particular interpretation was not placed on the increased intestinal peristalsis. Laboratory tests did not reveal anything unusual in the urine and blood. Fractional analysis of gastric content disclosed complete absence of free hydrochloric acid. Roentgenographic studies of the chest, stomach, and colon were entirely negative, but cholecystography revealed a poorly functioning gall bladder. Since the evidence seemed to point toward low grade infection of the gall bladder, the patient was treated medically with a smooth, high calorie diet designed to combat constipation, and with dilute hydrochloric acid.

Four months later the patient returned, feeling worse. The abdominal distention and discomfort in the right upper quadrant were more marked and the belching more severe. He stated that about every 5 minutes he suffered from mild attacks of pain coincident with the gurgling reduction in size of the distended abdomen. He also vomited more frequently, with relief of the distress. His bowels were inclined to be loose and the two or three daily stools were clay-colored. He had not had jaundice or colic.

Careful examination did not disclose anything further than achylia and a poorly functioning gall bladder. A diagnosis of probable cholecystitis was made, with the possibility of chronic intestinal obstruction. In view of this fact exploratory laparotomy was advised.

At operation, the gall bladder was found to be perfectly normal. It was next observed that the proximal part of the jejunum was enormously dilated and hypertrophied. Further exploration revealed a large, right paraduodenal hernia containing at least three-quarters of the small intestine (Fig. 1). The orifice of the hernia was oval in shape, about 10 centimeters in length, and was situated to the left of the mesentery and over the lumbar part of the spinal column. It was directed diagonally from left to right in about the same axis as the root of the mesentery. The superior mesenteric artery occupied the right anterior free edge of the opening and as it disappeared into the sac was kinked over the edge. The entering coil of jejunum, about 60 centimeters from the duodenojejunal juncture, was enormously dilated and hypertrophied. The emerging coil of ileum was collapsed. When the hand was inserted the hernia was found to be of huge size, to extend about 22.5 centimeters down and to the left toward the left iliac fossa, and to lie entirely behind the posterior parietal peritoneum.

When the contained intestine was withdrawn, it was found to be in a most remarkable condition. About 30 centimeters proximal to the point where the ileum left the hernia and about 120 centimeters from the ileocæcal valve, was a hard, fibrous, thickened, concentric contraction of the wall of the bowel 3 centimeters in length, the lumen of which would scarcely admit the tip of the finger. It re-

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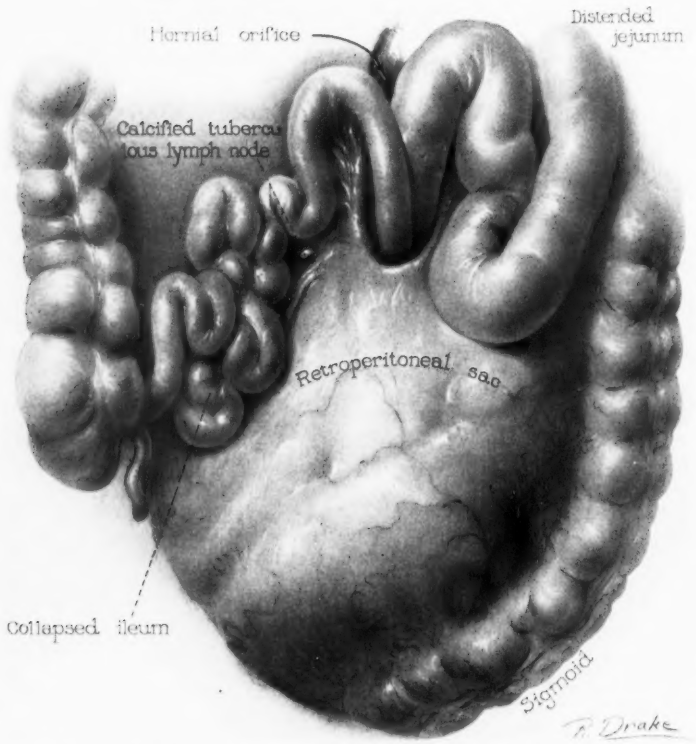

Fig. 1. Right paraduodenal hernia showing small intestine herniated into large retroperitoneal sac.

sembled somewhat the pylorus. The distal loops of intestine were collapsed. The proximal loops were enormously and irregularly distended, hypertrophied, congested, and filled with fluid. Just proximal to the obstruction, the ileum was in size equal to that of a capacious stomach. Ninety centimeters proximal to this it had narrowed somewhat but would still have admitted the whole hand. The walls were at least four times the normal thickness of the ileum (Fig. 2). After the hernia was reduced, the opening was closed with a number of interrupted stitches of catgut. At this point in the operation it was noted that the mesentery of the small intestine contained many calcified tuberculous lymph nodes in the region draining the intestinal tumor. At the time, these were thought to represent old healed tabes mesenterica. In view of the fact that the possibility of a malignant condition had to be considered and that the obstruction of the bowel was thought to be due more to the contracted region than to the hernia, the pylorus-like mass was resected from the ileum and an end-to-end anastomosis was performed. At the same time, an enterostomy tube was inserted into the most dilated portion of the ileum in order to prevent any ileus which might result from the extensive handling of the bowel. The fluid in the ileum was markedly blood stained. The condition was one of subacute intestinal obstruction.

The postoperative course of the patient was fairly uneventful. Fluids by mouth were withheld for 4 days. During this time, 10 per cent solution of glucose and 1 per cent sodium chloride were administered subcutaneously and intravenously. On the eighth postoperative day the enterostomy tube slipped out coincidentally with the establishment of normal bowel movements. Following this the patient recovered rapidly.

Pathological examination of the resected specimen showed it to consist of 5 centimeters of ileum, in the wall of which was a firm, nodular, annular mass, 3 centimeters in length, involving its whole circumference and producing almost complete obstruction of the lumen (Fig. 2). Through this a lead pencil could scarcely be passed. The wall of the bowel proximal to the lesion was markedly thickened and hypertrophied, particularly as regards the muscular layers. It measured 5 millimeters in thick-

Fig. 2. The hernia reduced. Tuberculous obstructive lesion and huge dilatation of the proximal ileum and jejunum are shown. Insert, the tumor in longitudinal section.

ness. The portion of the wall of the bowel distal to the lesion was of normal appearance and thickness. The peritoneum covering the lesion was markedly fibrosed and finely granular, although typical tubercles were not visible. On section the involved area was 1 centimeter in thickness from the mucosa to the peritoneum. The mucous membrane appeared polypoid and heaped up, and to occupy practically the whole lumen, but ulceration could not be observed. The cut surface was uniformly firm, dull white, and seemed to consist chiefly of fibrous tissue.

Microscopically the mucosa was found to be everywhere intact; the polypoid appearance observed grossly was due to tremendous infiltration of the mucosal villi by small lymphocytes, plasma cells, and particularly by eosinophilic leucocytes (Fig. 3). The submucosa was markedly increased in thickness both by the cells mentioned and by fibroblasts and epithelioid cells. A large number of sections was made to determine the presence of typical tubercles in this region, and they were identified only after considerable searching (Fig. 4). The muscular layer was enormously hypertrophied and infiltrated with small lymphocytes, fibroblasts, and epithelioid cells. In this region fewer eosinophiles were noted and giant cells were not identified. In the subserosa was striking hyperplasia of fibrous tissue and an increase in the amount of tuberculous granulation

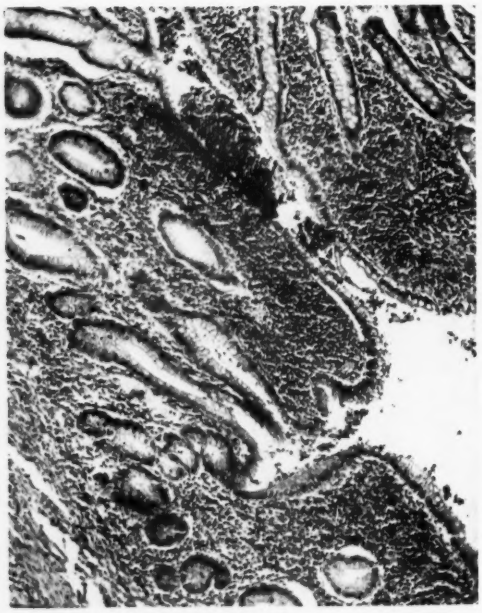

Fig. 3. Photograph of a portion of the mucosa in the tumor showing the intact epithelium and the dense submucosal cellular infiltration. (× 75).

Fig. 4. Photomicrograph of a typical tubercle with giant cells in a section taken from the obstructive lesion. (× 75).

tissue. Concentric aggregations of lymphoid cells, surrounded by epithelioid cells and fibroblasts, were more numerous here than elsewhere. None of these was necrotic. Giant cells were more easily found, but they were not numerous in any section. An epithelioid cell reaction combined with fibrous tissue hyperplasia appeared to be the most prominent feature of this region. The impression was gained that this was a very old lesion. This impression was strengthened by the discovery at operation of several calcified tuberculous mesenteric lymph nodes in the region draining this particular segment of bowel. In view of the absence of mucosal ulceration, the diffuse hyperplasia of fibrous tissue infiltration with lymphocytic and epithelioid cells, the relative absence of tuberculous giant cells, and the noncaseating nature of the lesion, the diagnosis was considered to be hyperplastic tuberculosis of the ileum.

PARADUODENAL HERNIA

Nagel, in his comprehensive report in 1923, found only 29 cases of the rare right paraduodenal hernia and more than 100 of the more common left variety. In these 29 cases, 12 of the patients had been operated upon with resultant cure of 2 and death of the remaining 10. Novak and Sussman, in 1924, reported an additional case, in which cure followed operation, and Bernardbeig reported that operation was not successful in a case in which acute obstruction had occurred. In 1925, Brown added his case in which operation was successful, with a summary of those already reported. He found a total of 32 cases, in 15 of which operation had been done with 11 deaths and 4 recoveries; in the other 17 cases the condition was found at necropsy. The case forming the basis of this report represents the thirty-third with right paraduodenal hernia and the fifth patient to be cured by operation, despite the added handicap of most severe and long standing chronic tuberculous intestinal obstruction. The diagnosis has not been made before operation or necropsy in any case. This case is the third in which paraduodenal hernia has been observed in The Mayo Clinic. The first, a left-sided hernia, was reported by Desjardins; the second, a typical right paraduodenal hernia, was reported by Nagel. Both were found at necropsy.

Moynihan, to whom much of our knowledge of retroperitoneal hernias is due, described 9 varieties of peritoneal fossæ in the immediate neighborhood of the duodenojejunal juncture. Of these only 3 cases, or possibly 4, have any practical significance from the standpoint of herniation. These are the superior and inferior paraduodenal fossæ, the fossa of Landzert, and that called by Moynihan the mesentericoparietal fossa, and by others the fossa of Waldeyer. Anatomically the first and second are most commonly seen and consist of thin, avascular double folds of peritoneum running transversely from the duodenojejunal juncture to the posterior abdominal wall. The space normally included beneath them scarcely admits the finger tips. When they are not more than 2 to 3 centimeters apart they are usually united laterally, forming a semicircular fold which contains, about 5 millimeters from its free edge, the inferior mesenteric vein and a branch of the left colic artery. The space beneath this fold, when present, constitutes the fossa of Landzert. When the superior and inferior paraduodenal folds are widely separated, the fossa of Landzert does not exist. Left paraduodenal hernia is generally believed to occur into this fossa and to course upward, outward, and to the left behind the posterior parietal peritoneum. The two other characteristics of this type of hernia are that the orifice is turned toward the right and its anterior free edge contains the inferior mesenteric vein. It is the most common of all varieties of retroperitoneal hernia. The case reported by Desjardins was of this kind. Coley (8) recently reported a good example of the condition.

The mesentericoparietal fold is described as lying at the root of the mesojejunum, anterior to the lumbar part of the spinal column, and containing the superior mesenteric artery in its anterior free margin. The fossa so formed lies to the right of the body and its orifice opens toward the left. In the opinion of Moynihan, this fossa is always responsible for the development of right paraduodenal hernia. On the other hand, Nagel, from an examination of a large number of fetuses and bodies seen at necropsy, did not find examples of this fossa, but described in several instances an exceedingly low situation of the inferior paraduodenal fold, such that it was practically in the position of Moynihan's mesentericoparietal fossa. Although he did not deny the possibility of right paraduodenal hernia occurring into the fossa of Waldeyer, he concluded that it could sometimes take place into the inferior paraduodenal fossa, particularly when this was situated near the beginning of the third portion of the duodenum. The drag of the hernial contents would then quickly cause the descent of the orifice by the peeling back of the superior peritoneal margin until it was arrested by the first fixed structure it could encounter, namely, the superior mesenteric artery. In this way the superior mesenteric vessels would come to lie in the right anterior border of the orifice. Nagel's explanation seems to be a rational one. In an experience gained from more than 1,200 necropsies, in which an

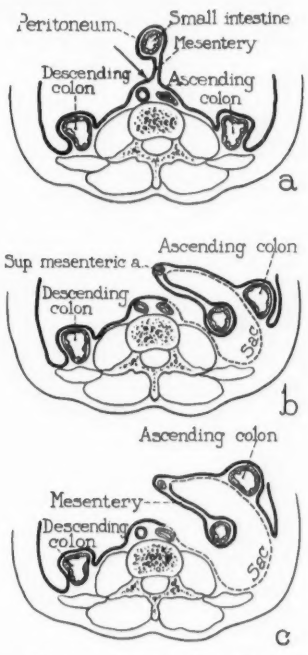

Fig. 5. *a*, The normal disposition of the peritoneum; *b*, the relationship of the small intestine and the hernial sac to the peritoneum; *c*, a further stage showing the ascending colon lying anterior to the hernial sac.

examination as a routine was made for abnormal peritoneal folds, we did not find mesentericoparietal folds of noteworthy size but did encounter several inferior duodenal fossæ of large dimensions, and one into which the whole hand could be inserted, but which did not contain bowel. Sistrunk recently found a large fossa of Landzert which would admit the whole hand but which did not contain loops of bowel. It would seem that the sac may exist as a potential hernia throughout life. Andrews was opposed to the explanation of both Moynihan and Nagel on the basis that the condition is not a hernia in the true sense of the word but rather a congenital anomaly due to imprisonment of the small intestine beneath the mesentery of the developing colon. He strongly objected to the conception of a *vis-a-tergo* which could produce a hernial sac from one of the normally insignificant paraduodenal fossæ. He pointed out that differential pressure cannot occur in the abdomen; that hundreds of such fossæ, none of which contains herniated bowel, exist in the abdomen; that the herniation is usually total or subtotal; and that the hernias are practically always small. His explanation, although plausible, is not without its objections. It does not explain, for instance, the anterior situation of the sac in the case reported by Brown. Of the many theories advanced, the most rational seems to us to be that which considers such sacs of congenital origin or as variations of the normal process of zygosis. In this way they are somewhat analogous to the congenital inguinal sacs. That they are occasionally found to be of considerable size without contents is undoubted. Once a loop of bowel becomes included within such a potential peritoneal sac the *vis-a-tergo* derived from vigorous peristalsis is by no means lacking and enlargement rapidly occurs. This force would further account for large hernias found either in childhood or in adult life.

Whether right paraduodenal hernia occurs into the inferior paraduodenal fossa or into the fossa of Waldeyer, its characteristics are that the orifice finally lies practically in the median line or slightly on the right side of the spinal column, that it is turned to the left, and that it contains the mesenteric artery in the right free border. Furthermore, the hernia passes downward and generally to the right behind the parietal peritoneum and the colon. In Brown's case, the sac lay anterior to the peritoneum and the colon, although in other respects it was typical of the condition. When the sac is large, as it generally is, it may contain large amounts of small intestine. The usual disposition of the sac with regard to the parietal peritoneum is illustrated in Figure 5.

Pathological features. Intestinal obstruction is the most common pathological feature of the condition. Usually, when clinically obvious, it is acute. Of the 33 cases reported in the literature, obstruction was acute in 15, subacute in 1 case, and chronic in 1. Operation was undertaken in 14 cases for this complication alone. Obstruction is also the outstanding cause for the symptoms from which the patient suffers. It is caused by constriction of the orifice, by adhesions at this site, or by volvulus of the contents at the neck of the sac. An extrahernial cause may be duodenal obstruction from dragging on the superior mesenteric artery. In the case reported here, obstruction, although occurring entirely within the sac, apparently had little to do with the mechanics of the hernia, for the area of hyperplastic tuberculosis was situated not at the neck of the sac, but at least 30 to 35 centimeters proximal to the point of emergence of the ileum. The bowel distal to it was collapsed and that proximal to it enormously dilated and hypertrophied. On this basis, it must be assumed that the tuberculous lesion was at least 12 years old, a point which will be discussed further. Chronic and long standing obstruction may give rise to dilatation and hypertrophy of the intestinal wall of an extreme nature. In this case the ileum and jejunum had reached enormous proportions (Fig. 2).

Clinical diagnosis. The fact that right paraduodenal hernia never has been diagnosed before operation or necropsy indicates that the clinical symptoms are at the best vague and indeterminate. In certain cases the condition has been symptomless; in other cases, vague dyspepsia suggestive of chronic

cholecystitis, chronic duodenal ulcer, or, as Brown suggested, chronic duodenal ileus may lead to long continued and unavailing medical treatment or to operation. When the symptoms become of definite clinical significance they may assume the aspect of recurrent attacks of subacute or chronic strangulation or of acute intestinal obstruction. Vomiting is uncommon and is usually confined to bile stained mucus even when obstruction becomes complete. Brown stated that fæcal vomiting cannot occur, owing to the high situation of the obstruction, but this certainly would not hold true in our case in which the obstruction was within 120 centimeters of the ileocæcal valve. Visible peristalsis and a palpable, resonant, gurgling, balloon-like tumor in the lower right abdominal quadrant, later involving the whole abdomen, are considered by Moynihan to be the most significant diagnostic signs. That this tumor bears a definite relation to the clinical condition of the patient is well exemplified in our case. During the attacks of dyspepsia, the tumor became tense and tender, and coincident with a series of sharp pains in the right upper quadrant became visibly smaller, with the association of marked borborygmi. Roentgenographic studies have not aided in the diagnosis. In Nagel's case, the colon was found to be on the left side, with the small intestines grouped to the right; this appearance was interpreted as representing incomplete rotation of the intestine. In our case, roentgenographic studies of the stomach and colon gave entirely negative results. It is not clear why the dye test should have indicated a poorly functioning gall bladder. When complete strangulation occurs, the picture is more obvious. It is accompanied by severe toxæmia and collapse, owing to the large amount of small intestine involved.

Treatment. The treatment of the condition is essentially surgical. The reduction of the hernia is easily attained, since adhesions are not often found. In Brown's case it was possible to remove the entire sac by everting it, but in the usual type this is not feasible. It is, however, very necessary to close the orifice to prevent recurrence, an accident which has occurred in at least 2 cases (21, 26). During this procedure the large vessels at the neck of the sac should be carefully avoided. Because of their presence, the neck should be enlarged only with the greatest caution. It is, of course, entirely because of the difficulty in diagnosis and the severity of the intestinal obstruction for which operation is most often performed that the mortality is so high.

HYPERPLASTIC INTESTINAL TUBERCULOSIS

According to the French classification, tuberculosis of the intestine exists in 4 pathological forms (4, 6): (1) The ulcerating, lenticular type commonly known as tuberculous enteritis; it may exist as a primary lesion in children but in adults is practically always secondary to advanced pulmonary tuberculosis. (2) The cicatricial, or stenosing, type resulting from healing of an annular ulceration of the wall of the bowel. The lesion may be single or multiple and commonly affects the small intestine. Its appearance is that of a ligature tied around the bowel. In the ileum it may produce marked obstruction, but rarely does so in the large intestine, where it forms a shelf-like projection into the lumen. The literature contains many reports of this type of ileal involvement (16, 29). Although the pathological effects are the same and the treatment is identical, it should be sharply distinguished from the variety occurring in our case. (3) The enteroperitoneal variety is characterized by ulcerating, caseating lesions of the ileocæcal segment, with peritoneal and lymphatic involvement and a marked tendency to softening and suppuration. External fistulæ and spontaneous entero-enteroanastomosis is common. Very large caseous lymph nodes frequently co-exist with the condition. (4) Chronic hyperplastic tuberculosis is a distinctive variety of tuberculosis and was first described by Hartmann and Pilliet in 1891. Conrath later reviewed 77 cases and considered them carefully from a surgical standpoint. Lartigau's monograph, however, may be considered the most exhaustive pathological study of the whole subject. Little has been added since its appearance.

Lartigau defined chronic hyperplastic tuberculosis as a peculiar form of tuberculosis,

affecting various segments of the intestinal canal, and characterized by a variable, but considerable, hyperplastic, annular thickening of the wall of the bowel, which is bound to the parietes by adhesions so that the tumor is rarely free or movable. In most cases (90 to 95 per cent), it affects the ileocæcal region, here constituting the well known ileocæcal tumor. Occasionally the rectum is involved, less commonly the ileum in conjunction with the cæcum, and almost never the ileum alone. It is a disease of long duration; the most conspicuous feature is the extensive formation of fibrous and tuberculous granulation tissue in the involved regions. Necrosis and caseation, as a rule, do not occur, and ulceration, unless of the ordinary enteric type, is not seen. The chronicity of the disease and its low grade of inflammation are believed to be due either to an attenuated bacillus, or to one of low virulence, elaborating small quantities of exotoxin sufficient only to produce proliferation, and not necrosis, of fibrous tissue. The formation of tumor is the ultimate result. Clinically, this may be mistaken for carcinoma and even at operation the diagnosis is not always clear (19, 27). Lartigau stated that many of the early cases of cæcal resection for supposed malignant conditions reported as cured were really examples of this condition. On section the lesion has the uniform, whitish appearance of hyperplastic fibrous tissue. The blood supply appears to be relatively well preserved; this probably accounts for the absence of caseation-necrosis. The mucosa becomes heaped up and assumes a polypoid or papillomatous appearance, due to the underlying infiltration. This process continues to the complete obliteration of the lumen of the bowel. Involvement of the regional lymph nodes, with or without caseation, is the rule. In the rectum the condition may be mistaken for syphilis.

Microscopically the process is essentially a mixture of a purely tuberculous and a simple inflammation, so that the picture necessarily varies within wide limits. If the mucous membrane is intact, as it often is, the epithelium is normal, but the villi are greatly enlarged and swollen with masses of lymphoid and epithelioid cells and occasional typical tubercles. Fibroblasts are thickly interspersed in the region of cellular infiltration. These polypoid masses often alternate with areas of ulceration of the same cellular appearance, except that the superficial epithelium is absent and fibroblasts are more numerous. The submucosa is greatly thickened by fibroblastic hyperplasia and by lymphoid cells. Giant cells are considered to be most common here. In the muscular layer is seen marked hypertrophy of the muscle bundles, which are separated and in places destroyed by aggregations of lymphoid and epithelioid cells. In the subserosa many lymphoid collections and fibroblasts are to be seen. Considering the uniformity and intensity of the cellular infiltration, it is surprising that necrosis does not occur. The wealth of blood vessels probably accounts for this. All authors are agreed that the microscopic evidence of tuberculosis is exceedingly atypical and that careful search must be made before tubercles and foci of tuberculous granulation tissue are discovered. In some cases, only the identification of the organism makes the diagnosis certain. In our case giant cells were scanty, but typical foci of tuberculous granulation tissue were much in evidence beneath the serosa and in the submucosa. The diffuse cellular nature of the infiltration should not deceive one into calling the lesion sarcomatous.

Hyperplastic tuberculosis is not only confined to the intestinal canal but is seen occasionally in serous membranes, in the larynx, and in lymph nodes. In the last situation it may resemble Hodgkin's disease so closely that only the discovery of the bacilli of tuberculosis serves to make the diagnosis. Hyperplastic tuberculosis of the small intestine, occurring in conjunction with cæcal tuberculosis, is uncommon (2, 11, 30), but as a single isolated lesion it appears to be exceedingly rare. Kaufmann apparently grouped it with the stenosing and cicatricial type of tuberculosis of the small intestine. It is scarcely mentioned in the extensive monograph of Huebschmann. The following is quoted from Lartigau:

"Hyperplastic tuberculosis of the small intestine is rare. Here it is not so often a ques-

tion of those large tumor masses so easily taken for carcinoma; the growth is ordinarily more limited and less voluminous. Nevertheless the other features of the pathological and clinical picture are present; even more complete stenosis has been observed. Although the lesion of the small intestine may exist without cæcal disease it is oftener found that the two are concomitant. In a few instances, however, the hyperplastic tuberculous disease has been confined to the ileum, the part near the cæcal end being affected."

Lartigau could find only 2 cases of this disease limited to the small bowel. In 1 case, reported by Pantaloni, there was isolated involvement of the ileum for a distance of 12 centimeters and the caliber of the bowel was reduced to half its former size. The other case, that of a girl aged 17 years, was reported by Guinard. There were four regions of stenosis which had produced marked obstruction for 15 years. The small intestine proximal to the obstruction was dilated to a size resembling that of the stomach. Extensive resection was performed and the patient recovered. The condition of the obstructed intestine must have been similar to that in our case. The third case was reported by Soubeyran. It occurred in a woman aged 25 years. The lesion involved 9 centimeters of the ileum and death occurred 19 days after resection. Michon reported a case in which the condition existed in the terminal 5 centimeters of the ileum, unaccompanied by any cæcal disease, but with markedly enlarged mesenteric lymph nodes. The patient, a woman aged 26 years, presented the signs and symptoms of acute appendicitis and for this reason was subjected to exploration. The tumor was resected without difficulty and lateral anastomosis between the terminal portion of the ileum and ascending colon was performed. The patient recovered. Ransohoff reported the fifth example of the condition; the patient was a boy aged 9 years; tuberculous cervical lymph nodes had been removed in the previous year. This case is of considerable interest because of the situation of the lesion and the presence of active tuberculosis elsewhere. The lower part of the jejunum was involved for a distance of 17.5 centimeters and the regional lymph nodes were also involved. Resection and end-to-end anastomosis were performed, and recovery ensued.

The sixth case was reported by Estor, Grynfeltt, and Aimes. A localized cancer-like mass was found in the terminal portion of the ileum of a woman aged 35 years. It had produced obstructive symptoms for some time previously, and at operation the proximal part of the ileum was found to be markedly dilated but not hypertrophied. The tumor and the enlarged regional lymph nodes were resected; the impression was that the lesion was carcinomatous, but pathological examination showed it to be an example of hyperplastic tuberculosis. This was the only evidence of active tuberculosis presented by the patient. Recovery was complete.

In our case, the seventh on record, other active foci of tuberculosis were not discovered after careful clinical investigation. Roentgenograms of the chest repeatedly gave negative results. Although it is not possible to state whether the intestinal lesion was due to a primary or to a secondary infection, it is certain that at the time of its removal it represented the only active focus of clinical significance. In view of its long duration in the bowel, it is not surprising that the mesenteric lymph nodes were calcified, and for this reason it appeared safe to leave them *in situ*. Gross and microscopic examination of the resected specimen proved it to be a typical example of true hyperplastic tuberculosis. The pathological features of this disease already have been discussed; attention should be called, however, to the gross resemblance of the lesion to carcinoma and to the superficial microscopic resemblance to lymphosarcoma.

Symptoms. As the progress of such a lesion is toward obstruction of the bowel, it is not surprising that the symptoms are practically identical with those already enumerated as arising from a paraduodenal hernia. Koenig summed them up in the syndrome of "ballooning of the intestines, visible peristalsis, clapotage, borborygmi accompanying the colic and with the appearance of an elongated tumefaction." Here the symp-

toms were no doubt due to the tuberculosis rather than to the hernia.

Treatment. In none of the cases, with the exception of that reported by Ransohoff, did there appear to be active tuberculosis elsewhere. Whether one regards the hyperplastic infection as primary or secondary, it is the rule that the co-existing tuberculosis in other parts of the body is not clinically significant. Radical resection of the affected segment is, therefore, the operation of choice and intestinal anastomosis is carried out by the most suitable method. In the small intestine this is practically always possible, because of the mobility of the lesions and their freedom from adhesions. If radical excision is impossible, lateral anastomosis between afferent and efferent loops may be performed. Erdman believes that ileostomy in the afferent loop should be considered only as a last resort. The insertion of an enterostomy tube into the afferent loop by the Witzel method is, however, a wise precaution if the condition of the obstructed bowel warrants it.

THE RELATIONSHIP OF THE TWO LESIONS IN THE CASE REPORTED

The isolated tumor found in the ileum, and considered to be the actual cause of the enormous dilatation and hypertrophy of the herniated bowel, proved after resection to represent a typical example of chronic hyperplastic tuberculosis, which, when it occurs in the cæcum, is known as "ileocæcal tumor" (Duranti), "typhilitis resembling cancer" (Hartmann), or the "real surgical tuberculosis of the cæcum" (Bérard). Suspicion of its true nature was not entertained at the time of removal, and it was considered to be either a chronic inflammatory process due to some intrahernial abnormality or possibly a scirrhous carcinoma of the small intestine. Even the presence of several calcified mesenteric lymph nodes as large as 2 centimeters in diameter did not impress one with the possibility of active tuberculosis in the wall of the bowel, a common condition in civilized native races. These calcified nodes were thought to represent old healed tuberculous infection of childhood. Furthermore, the fact that the tumor was small, annular, single, and situated at least 120 centimeters from a perfectly normal cæcum, appeared to make the diagnosis of tuberculosis highly improbable. Examination of the gastro-intestinal tract, from the stomach to the sigmoid, showed only one such lesion to be present. The definite possibility of carcinoma and the obvious obstruction produced by the lesion led to its removal and pathological examination. This was done only after due consideration of the added risk to the patient.

Just why two such exceedingly uncommon pathological conditions should occur together is not at first sight clear. A consideration of their etiology, however, affords what is probably the most rational explanation, and supports the view that it was something more than mere coincidence. As has been pointed out, paraduodenal hernia is frequently devoid of symptoms and may exist throughout the lifetime of the patient without causing suspicion of its presence. Whether clinical symptoms are produced or not, however, a hernial sac of such proportions constitutes an ideal situation for the development of intestinal stasis. It has long been known that the reason for the occurrence of hyperplastic tuberculosis at or near the ileocæcal valve and in the rectum is due to the marked slowing of the intestinal stream in these regions. The bacilli of tuberculosis are here enabled to gain a foothold in the mucosa. Without a primary focus in the cæcum, there is little chance for this to occur normally in the small intestine. In this patient no doubt the hernia provided the region of ileal stagnation, with resulting tuberculous infection. Parallel examples are to be seen in the occurrence of tuberculosis in a Meckel's diverticulum. Coley (7) reported such a case and reviewed 9 others from the literature. Here again stagnation of food in the diverticulum no doubt accounted for the tuberculous infection of the wall. The condition of the afferent loops of intestine and the character of the obstruction leave little doubt in our minds that the majority, if not all, of the symptoms from which the patient suffered were due to the tuberculosis and not to the hernia.

SUMMARY

A case is reported of right paraduodenal hernia in association with marked obstruction of the herniated small intestine due to an isolated tumor resembling carcinoma but of hyperplastic tuberculous origin.

This is the thirty-third example of right paraduodenal hernia reported, the sixteenth patient with this condition to be operated upon, and the fifth to recover following operation. Isolated hyperplastic tuberculosis of the small intestine is rare; only 7 cases have been reported. The two lesions in association make the case unique. A discussion of the clinical and pathological features of each condition is given.

The presence of tuberculosis in the hernial sac is interpreted as being due to stagnation of food and to the slowing of the intestinal current in the sac. The conditions were thus similar to those under which the same type of tuberculosis occurs in the cæcum.

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THE EFFECT OF CHOLECYSTENTEROSTOMY ON THE BILIARY TRACT[1]

GATEWOOD, M.D., F.A.C.S., AND STANLEY E. LAWTON, M.D., CHICAGO

ANASTOMOSIS of the biliary tract to the intestinal tract has been discussed extensively in the literature during the past few years. There is still much difference of opinion about the type of operation to be done and the indications for such operations. In 1922, Poppens and one of us (2) reviewed the literature and reported the results of our experiments on a series of 42 dogs. We came to the conclusion that, from an experimental standpoint, infection of the liver and biliary tracts invariably follows cholecystenterostomy. Since then, a number of others (Horsley, Lehman, Beaver) have repeated these experiments, and without exception have arrived at the same conclusions. Nevertheless, Wangensteen concludes that in man evidence of infection after anastomosis of the gall bladder to the stomach rarely occurs. Ladd, in 1928, reported three successful cholecystoduodenostomies and one cholecystogastrostomy done in children for relief of congenital stenosis or atresia of the ducts. In a personal communication, he states that "as far as we know these children who have cholecystenterostomies do not have hepatitis or cholangitis as a sequel to the operation." Lowenstein reported 9 cases in which operation was done from 1 to 9 years previously without clinical evidence of infection, and Hans Kehr, who has championed this operation and has performed it more than sixty times, feels that hepatic infection is rare. Recently, Walters reported 8 cases in which anastomosis of the gall bladder or common duct to the stomach or duodenum had been done. Six patients survived. Four of these patients are clinically well. Judd, in 1928, reported the only postmortem results we have been able to find. Although this patient was clinically well, autopsy revealed multiple liver abscesses. Beaver states[2] that he knows of one other similar case in which marked evidences of liver infection were found at autopsy.

[2] Personal communication.

A review of our hospital records adds little to the solution of the problem. Anastomoses between the gastro-intestinal and biliary tracts have been done only for very definite indications, such as obstruction of the common duct due to carcinoma of the pancreas, or stricture. From our records of 23 cases, most of which have been done within the last 10 years, we find that several of our patients are clinically well some years after operation. Most of the patients operated upon for carcinoma died before one could obtain evidence of bile tract infection, although some of these patients were temporarily very materially improved. For example, Mr. F. L. (Hosp. No. 220559) upon whom we did a cholecystogastrostomy May 21, 1928, gained weight temporarily and was clinically much improved. His jaundice of almost 5 months' standing completely disappeared after operation. He died 3 months later of carcinoma of the pancreas. Although patients may live a long time with no bile passing into the intestinal tract, there is no question about the physiological benefit of the bile on intestinal digestion, to say nothing of the additional comfort to the patient from internal drainage. Two of our patients (Mrs. M. R., Hosp. No. 203223, and Mrs. H. W., Hosp. No. 227613), who had choledochoduodenostomies performed 27 and 8 months ago, for obstruction of the common duct, have been clinically well without evidence of infection. A third patient (Mrs. C. S., Hosp. No. 210282), was operated upon on April 8, 1927, for recurrent cholangitis due to a stricture of the hepatic duct. Following hepaticoduodenostomy, she reports that she is much improved, although she continues to have an occasional attack of epigastric pain. There has been no jaundice, however. A fourth patient, Mrs. L. F., who had a cholecystogastrostomy performed for common duct obstruction by Dr. E. Wyllys Andrews in 1917, has been clinically well since. A recent fluoroscopic examination

[1] From the Department of Surgery, Rush Medical College of the University of Chicago, and Presbyterian Hospital, Chicago.

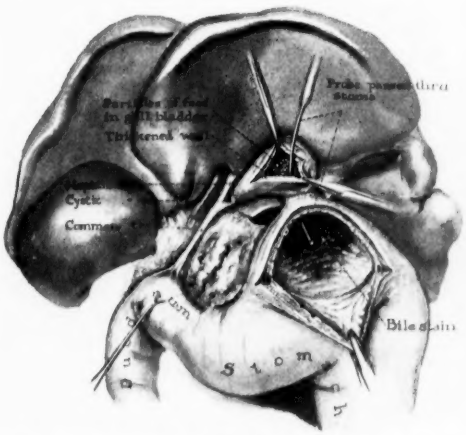

Fig. 1. Dog 26. 146 days. Showing patent stoma and thickened gall-bladder wall.

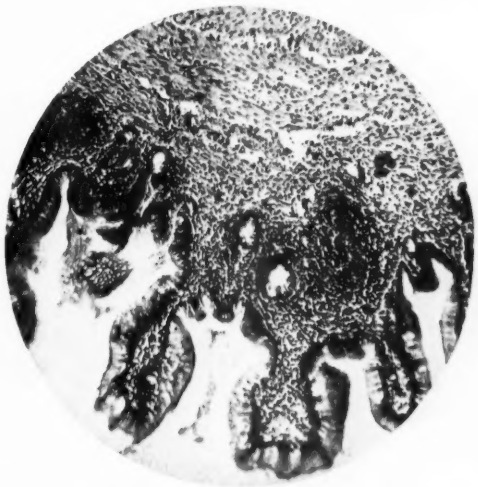

Fig. 2. Dog 34. 70 days. Chronic inflammation of common duct showing round cell infiltration among muscle bundles.

enabled us to find no evidence of the stoma by the use of the barium meal. On the other hand, one of our patients (Mrs. K. C., Hosp. No. 132,577) lived 5 years with occasional attacks of jaundice, chills, and fever. Autopsy revealed marked inflammation of the ducts and also severe hepatitis and cirrhosis. Another (Mr. J. W., Hosp. No. 130015) who had a cholecystocolostomy, developed evidence of hepatic infection within a short time after operation. Both from a physiological and experimental standpoint, anastomosis with the large bowel is unsound and rarely, if ever, indicated. We can find no case recorded in the Presbyterian Hospital since 1921.

As there is a growing tendency to perform cholecystenterostomy for a variety of pathological conditions, such as ulcer, impacted common duct stones, and chronic pancreatitis, it seemed to us worth while to find, if possible, some explanation for the differences between the clinical and the laboratory results, and the following experiments, therefore, were undertaken.

EXPERIMENTAL STUDY

The experimental work was carried out on a series of 20 apparently normal, healthy dogs weighing between 12 and 20 kilograms. As Beaver, Oddi, and others have shown that the presence of bile in the stomach in no way affects gastric digestion, and as the stomach seems to be the most logical viscus to employ, all anastomoses were made between it and the gall bladder. Under ether anæsthesia and by strictly aseptic technique, cholecystogastrostomy was performed, in much the same manner as a gastro-enterostomy is done,

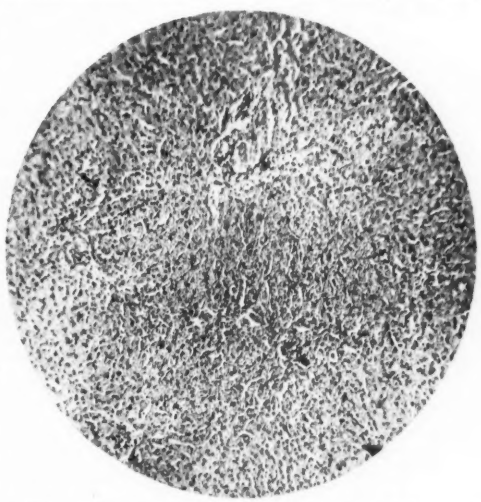

Fig. 3. Dog. 1. 51 days. Liver showing slight round cell infiltration. Otherwise normal.

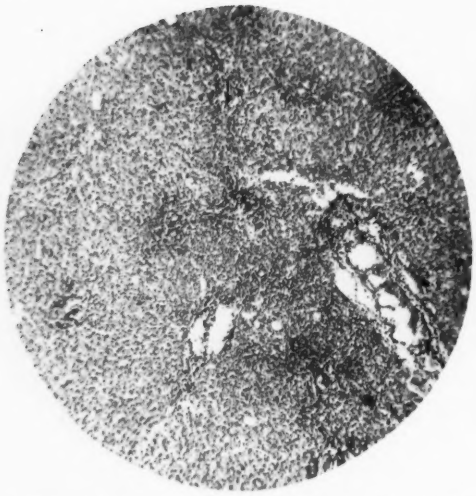

Fig. 4. Dog. 28. 30 days. Chronic retrogressive changes about central lobules. Ascending periportal lymphangitis.

Fig. 5. Dog 31A. 180 days. Showing results obtained in previous series when common duct was ligated. Note numerous round worms extending into the hepatic ducts.

two rows of fine silk suture being used to make the anastomosis. The site selected for anastomosis was about 3 centimeters above the pyloric ring and somewhat nearer the lesser than the greater curvature of the stomach. When completed, the lumen established between the stomach and gall bladder measured about 0.5 centimeter in diameter. Little difficulty was experienced in approximating the stomach and gall bladder and no undue tension resulted. The common duct was explored for signs of obstruction and in all dogs was apparently normal. The common duct was allowed to remain in its normal condition and was not ligated or obstructed. After sufficient time had elapsed for complete recovery from operation and healing of the abdominal wound, the dog's abdomen was again opened, cultures made from the liver, gall bladder, and common duct and sections removed for microscopic study. Fifteen days after operation, 4 dogs developed symptoms in an epidemic distemper and were killed for examination at that time. Sixteen dogs were examined at various intervals of from 21 to 146 days after operation.

Results. All dogs recovered from operation. With the exception of the 4 which developed distemper, all dogs were apparently in good health at the time they were sacrificed. In every instance evidence of disease was absent in the gross specimens of the liver, stomach, and common duct. The gall bladder mucosæ were thickened without exception (Fig. 1). Microscopic examination revealed pathological change in all livers and gall bladders. A few of the common ducts showed slight round cell infiltration (Fig. 2). In the livers the changes varied from a slight round cell infiltration to an ascending periportal lymphangitis with acute and chronic retrogressive changes about the central liver lobules (Figs. 3 and 4). The gall bladders showed varying degrees of round cell infiltration and thickening of the mucosa. Bacteriological examinations showed that the results were uniform throughout. Smears and cultures of the livers were all negative. In smears of gall-bladder bile and common duct bile many large Gram negative rods and few Gram positive rods were present. Cultures showed bacillus coli communis and bacillus proteus vulgaris present.

DISCUSSION

The results of this series of experiments show again that infection of the gall bladder, liver, and bile tracts follows cholecystogastrostomy in dogs. In this series, as contrasted to our previous series in which the common ducts were ligated and divided, there is no dilatation of the common ducts and no

SERIES I. OPERATION: CHOLECYSTOGASTROSTOMY ON LESSER CURVATURE OF STOMACH, COMMON DUCT NOT OBSTRUCTED

No.	Days lived after operation	Symptoms Cause of death	Pathology		Bacteriology	
			Gross	Microscopic	Smears	Cultures
7	15	Nasal discharge Killed	Liver—no changes Gall bladder—mucosa thickened Common duct—normal	Liver—acute retrogressive changes, especially about the central lobules Gall bladder—mucosa thickened with slight round cell infiltration	Liver—negative Gall bladder — large gram+ rods Common duct—few large gram− rods	Liver—negative. Gall bladder—bacillus coli communis. Common duct — bacillus coli communis.
28	30	Killed	Liver—no changes Gall bladder—distended with thick "muddy" bile. Wall thickened, mucosa chronically inflamed Common duct—normal	Liver—chronic retrogressive changes about central lobules. Ascending lymphangitis about portal canals and veins Gall bladder—mucosa thickened, marked round cell infiltration	Liver—negative Gall bladder—many large gram+ rods, few large gram− rods Common duct—few large gram+ rods	Liver—negative. Gall bladder—bacillus coli communis, bacillus proteus vulgaris. Common duct — bacillus coli communis.
1	51	Killed	Liver—no changes Gall bladder—mucosa slightly thickened. Bile thin, clear Common duct—normal	Liver—slight round cell infiltration, otherwise normal Gall bladder — slight round cell infiltration	Liver—negative Gall bladder—few gram+ rods Common duct — few gram− rods	Liver—negative. Gall bladder—bacillus coli communis. Common duct — bacillus coli communis.
34	70	Killed	Liver—small, yellow areas on upper surface of middle lobe Gall bladder—wall thickened, distended with thick bile. Mucosa chronically inflamed Common duct—normal	Liver—small amount of round cell infiltration with increased fibrous connective tissue Gall bladder—mucosa thickened, infiltrated with round cells Common duct—slight round cell infiltration	Liver—negative Gall bladder — large gram+ rods Common duct—large gram− rods	Liver—negative. Gall bladder—bacillus coli communis. Common duct — bacillus coli communis.
3	90	Killed	Liver—normal, few adhesions to diaphragm at site of anastomosis Gall bladder—distended with thick "muddy" bile, wall and mucosa thickened. Many adhesions Common duct—normal	Liver—chronic retrogressive changes with small amount of periportal round cell infiltration Gall bladder—mucosa thickened, small amount of round cell infiltration Common duct—normal	Liver—negative Gall bladder — large gram+ rods Common duct — large gram− rods	Liver—negative. Gall bladder—bacillus coli communis. Common duct — bacillus coli communis.
26	146	Killed	Liver—normal Gall bladder—bile thin, clear, wall about normal thickness. Mucosa very slightly thickened Common duct—normal	Liver—slightly increased fibrous tissue with small amount of round cell infiltration Gall bladder — slight round cell infiltration Common duct—normal	Liver—negative Gall bladder — large gram+ rods Common duct—large gram− rods	Liver—negative. Gall bladder—bacillus coli communis. Common duct — bacillus coli communis.

evidence of gross food particles or round worms in the lumina (Fig. 5). Infection is definitely less when the common duct is not ligated and divided. Such experimental differences suggest the following possible explanations for the differences between laboratory and clinical findings.

1. Since the most uniformly satisfactory results have been obtained in cases of pancreatitis, is it not likely that most of the bile soon passes into the duodenum by the normal route and that there is very little retention of foreign material in the gall-bladder? From two of our previous experiments and from the work of Lehman, we had been led to believe that the stoma of a cholecystogastrostomy would close in the absence of common duct obstruction. While in our present series of experiments the stomata remained patent, the tendency undoubtedly is for contraction. In some of our dogs, the gastric rugæ acted almost like a valve and probably partially protected the gall bladder from extraneous material. In Dr. Andrew's patient every attempt to visualize the gall bladder by pushing barium into it from the stomach was unsuccessful.

2. Many animals which were apparently healthy when sacrificed showed very definite bacteriological and microscopic evidence of hepatic infection. May there not be silent hepatitis in many of the patients who are clinically well? The postmortem findings in Dr. Judd's case would lend plausibility to this

theory. More autopsy data will probably settle this question.

3. Finally, may it not be possible that the human liver is better able to conquer biliary infection than that of the dog? It is well known that fat metabolism differs materially in the two.

CONCLUSIONS

1. From an experimental standpoint, infection of the gall bladder invariably follows cholecystogastrostomy, regardless of obstruction of the common duct. The anastomotic stomata remain patent at least 146 days.

2. Hepatitis and cholangitis are the rule in cholecystogastrostomy, but not to as marked a degree as in a previous series in which the common duct was ligated and divided.

3. Until better proof is obtained that the conditions in man are not parallelled in the experimental animal, we must conclude that anastomoses between the biliary and gastrointestinal tracts are not without danger of ascending biliary infection. While oftentimes a life-saving measure, such anastomoses should not be done for other than the most definite indications.

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POSTOPERATIVE PULMONARY ATELECTASIS

Report of an Unusual Case[1]

RICHARD H. OVERHOLT, M.D., EUGENE P. PENDERGRASS, M.D., AND SIMON S. LEOPOLD, M.D., Philadelphia

THERE appeared in 1850 a treatise by Sir William Tennant Gairdner on the consequences of bronchitis in which he described pulmonary collapse.[2] In 1908, William Pasteur called attention to the occurrence of massive collapse as a postoperative complication having previously observed this condition in postdiphtheritic paralysis of the diaphragm. In the next 17 years, according to Scott's published statistics, only 68 cases of postoperative massive pulmonary collapse were recorded in the literature. Since 1925, there has been a veritable flood of contributions concerning its symptoms, physical signs, roentgenological findings, and the mechanism of its production. Recently Bowen (1) has reviewed the subject comprehensively and has provided a complete bibliography.

The greatest interest in this condition has centered around the problem of the means whereby massive pulmonary atelectasis is produced. Bronchial occlusion followed by absorption of the imprisoned air has been clearly shown to result in an apneumatosis or atelectasis of the pulmonary tissue involved. Experimentally, as early as 1879, atelectasis was produced in rabbits by occluding the bronchi (13). In 1924, prior to the appearance of any published reports of a bronchoscopic examination during the course of this disease, one of us (12) stated the following: "If bronchoscopic examination during a collapse attack will demonstrate bronchial obstruction in the bronchus supplying the collapsed and drowned lung, then this explanation would seem correct, for those cases which occur postoperatively." Coryllos and Birnbaum have recently confirmed this conception experimentally, using obstructing balloons in the bronchi of dogs. Lee, Ravdin, Tucker, and Pendergrass have transferred, by means of a bronchoscope, obstructing mucus from a human affected with atelectasis to an animal and have produced the condition. However, Bradford in discussing massive collapse of the lung attempts to explain it on a neurogenic basis. He states that it is "an unusual condition in which the lung, without the presence of any gross lesion such as bronchial obstruction, pleural effusion, etc., interfering with the free entry of air, becomes airless to a greater or less degree." Bradford cites cases of traumatic origin, wounds of the buttocks, pelvis, and thighs or abdominal wall, in which massive pulmonary collapse occurred. Elkin (7) reports a case which followed fracture of the tibia. There have been other references to a non-obstructive type of pulmonary collapse so that the question of causation in all cases is not definitely established.

Many of those interested in the clinical study of postoperative pulmonary atelectasis have been impressed with the extraordinary density of the shadow produced on the roentgenogram by the involved lung. This is frequently so dense that the rib shadows are obscured. This fact has been commented upon by Scrimger, Sante (17), and Leopold (12).

Explanations for the extreme density, however, have not been discussed by many writers. We have recently had the opportunity to study an interesting case of massive atelectasis in which this particular phase of the condition presented some unusual features.

In conjunction with a study directed by Dr. George P. Muller, covering pulmonary complications following abdominal operations, the patient whose history follows was observed prior to and after operation during the preatelectatic stage, during collapse attack, and in the course of subsidence of pulmonary signs.

Mrs. L. M., aged 24 years, was admitted on November 20, 1928, to the University of Pennsylvania Hospital on the service of Dr. George P. Muller. The history was of 3 months' duration and

[2] Gairdner was probably the first to recognize pulmonary collapse in the adult and correlate its relation to bronchial obstruction. Writers, previously, had differentiated between "true hepatization and lobular condensation," but failed to remark as to the origin of the condition. Joerg (quoted by Gairdner) in 1832, clearly differentiated between what he termed areas of atelectasis and true lobular pneumonia in children.

[1] From Surgical Division B, and the Departments of Roentgenology and Medicine of the University of Pennsylvania Hospital. Presented before the Philadelphia Roentgen Ray Society, December 6, 1928.

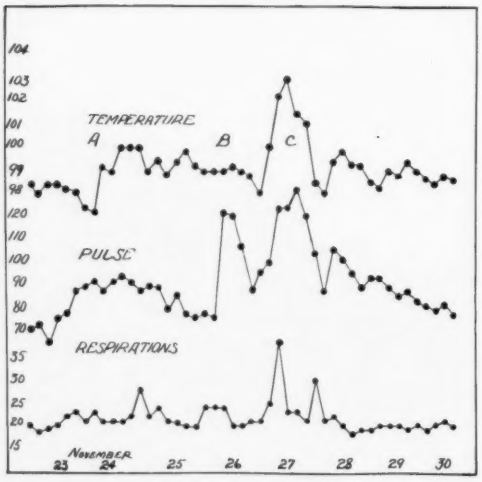

Fig. 1. Clinical chart showing temperature, pulse, and respiratory rate. *A*, Time of operation. *B*, Time that marked mediastinal shift was recorded (Fig. 3). Note the pulse rise at this time. *C*, Time of the appearance of roentgenographic density (Fig. 4). Note the sharp temperature reaction at this time only.

the symptoms were those typical of gall-bladder disease. There were no pulmonary symptoms. The history was otherwise irrelevant as were also the medical, family, and social histories. The patient was a well nourished young woman who grossly showed no evidence of any disease. Physical examination revealed nothing except some tenderness over the gall-bladder area. Routine blood and urine studies were negative. Cholecystographic studies were made, and the diagnosis of gall-bladder disease was substantiated. The roentgen examination of the chest was negative.

On November 24, operation was performed by Dr. Muller. Under ether anæsthesia the abdomen was opened through a transverse incision. Chronic calculous cholecystitis was found and a cholecystectomy and appendectomy were performed. The procedure was not particularly difficult and the intra-abdominal trauma was minimal.

The immediate postoperative reaction was slight. For 36 hours there were no symptoms or signs referable to the chest. On November 26, 48 hours after operation, the patient complained of a slight sense of pressure over the sternum and had an occasional cough without expectoration. There was no temperature elevation although the pulse was rapid. Examination of the chest showed limited expansion, slightly impaired resonance, and markedly suppressed breath sounds over the entire right chest. Posteriorly over the right lower lobe there were distant tubular breath sounds.

Under the fluoroscope in the recumbent position, it was noted that there was *a marked displacement of the mediastinum and heart to the right.* Surprisingly, *the right lung was practically clear.* The right dome of the diaphragm was elevated and fixed and the inter-rib spaces were narrowed. A bedside film was made and the fluoroscopic findings were confirmed. The roentgenologic diagnosis was massive atelectasis.

On the third day after operation (72 hours), there were no symptoms whatever, dyspnœa, cough, and expectoration not being present. The patient chose to lie on the unaffected side. For the first time, however, she began to have a febrile reaction and in the afternoon the temperature had reached 103 degrees. The examination of the chest was essentially the same as on the previous day except for more marked tubular breathing over the right lower lobe and sounds which were approaching normal in the upper lobe.

Another roentgenogram was made and the findings this time were quite different from those on the previous examination recorded 24 hours before. There was a marked density of the right middle and lower lobes and the mediastinal structures, although slightly displaced, had largely returned to their normal positions. The roentgenological diagnosis at this time was *massive atelectasis and drowned lung.*

As soon as the diagnosis of atelectasis was definitely established, the patient was put down flat in bed and rolled from side to side, and the affected side slapped, as suggested by Sante (21). Coughing was not produced nor was any sputum raised. The temperature fell, however, and was practically normal for the remainder of her convalescence.

On the fourth postoperative day (November 28), the patient was likewise symptomless and the physical signs were less in evidence. Over the right base posteriorly there were suppressed breath sounds of a bronchial type. No râles were heard. The roentgenogram at this time showed that the increased density of the right middle and lower lobes had largely disappeared, only some increased prominence of the trunk shadows remaining. There was no displacement of the mediastinal structures.

The remainder of the convalescence was uneventful, all of the physical signs in the chest having disappeared by the fifth postoperative day. A slight cough was present on the following day and on two occasions was productive of a small amount of sputum.

The vital capacity determinations were made pre-operatively and throughout the period of convalescence. The initial vital capacity was found in this case to be 2,600 cubic centimeters. After operation it fell to 600 cubic centimeters which represented a 77 per cent drop. This record closely corresponds to those made by one of us (14) after gall-bladder and gastric operations upon patients in whom no pulmonary complications

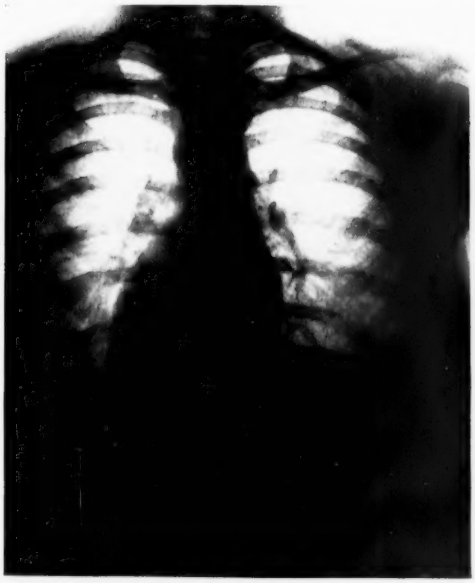

Fig. 2. Roentgenogram of patient made 24 hours before operation showing normal relationship of the domes of the diaphragm, intercostal spaces, and mediastinal structures. This picture was made with the patient in the erect posture, the film being anterior.

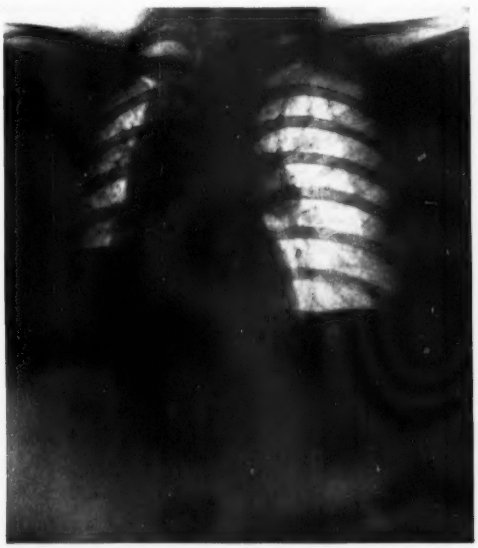

Fig. 3. Roentgenogram of patient made 48 hours after operation showing almost complete atelectasis of the right lung with only slight haziness. The displacement of the mediastinal structures and the elevation of the right dome of the diaphragm and the narrowing of the intercostal spaces were most marked at this time. At the roentgenoscopic examination the right dome of the diaphragm was fixed. Bedside examination, the film placed posteriorly.

were found. In a series of 25 cases, the vital capacity after operation averaged 33 per cent of the pre-operative record. Churchill and McNeil and Powers have reported similar reductions in the vital capacity after upper abdominal operations. It is surprising that in this case, the diminution in vital capacity was recorded 24 hours after operation, and not at the time the complete collapse took place, 48 hours later.

COMMENT

The features presented in this case, which are worthy of particular comment, are as follows:

1. The most marked displacement of the mediastinal structures to the affected side together with the greatest amount of elevation of the diaphragm occurred at the time *when there was only very little increased density of the right lung.*

2. The partial return of the mediastinal structures toward their normal position 24 hours later was observed at the time *when there was the maximum degree of density of the right middle and lower lobes.*

3. There was no elevation of temperature at the time of the most marked atelectasis, and the subsequent presence and subsidence of fever coincide with the appearance and disappearance of the lung density.

4. The usual clinical symptoms of a pulmonary complication—cough, dyspnœa and expectoration—were conspicuously insignificant. These phenomena will be discussed in the following paragraphs in the order detailed above.

All of the cases of postoperative massive pulmonary atelectasis which are recorded in the literature exhibit, on the first roentgenogram after the collapse attack, extreme density of the affected lung and maximum mediastinal displacement toward the affected side.

We were unable to find a single case in which postoperative massive atelectasis had occurred and been so diagnosed in the absence of gross

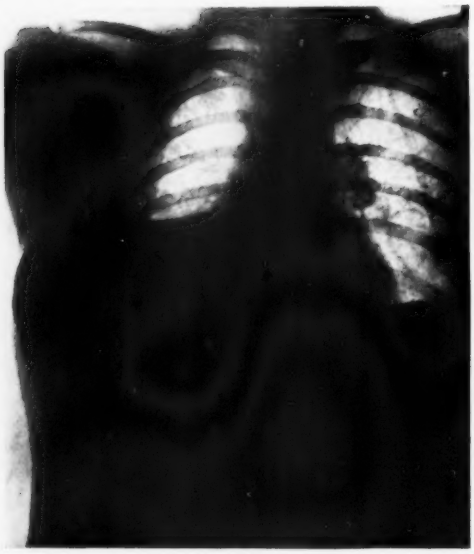

Fig. 4. Roentgenogram made 72 hours after operation showing marked increased density of the lower portion of the right lung due to atelectasis and drowned lung involving the right lower and middle lobes. Note that the heart has returned almost to its normal position. Bedside examination.

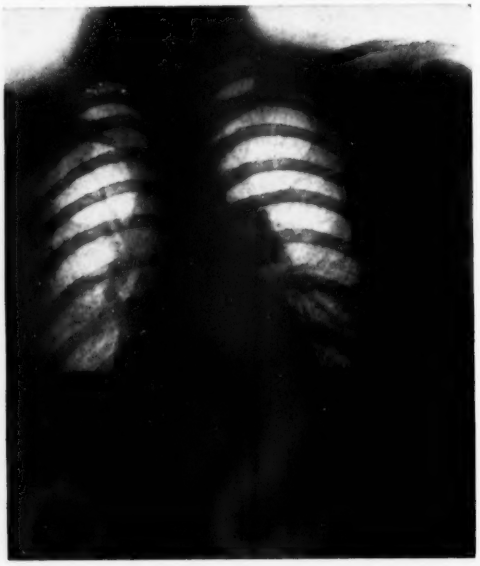

Fig. 5. Roentgenogram made 96 hours after operation shows that the density in the right lung has almost completely disappeared, the domes of the diaphragm have a normal relationship, and the heart is still slightly displaced toward the right. Bedside examination.

lung density. This fact makes it incumbent upon us to offer evidence in favor of our belief that the appearance demonstrated in Figure 3 is that of massive atelectasis. We, therefore, reviewed a number of roentgenograms of cases in which complete collapse of the lung had been produced by both artificial and pathological pneumothoraces. We found that the lung density was comparable in degree to the appearance demonstrated in Figure 3, and quite different from the dense shadow in Figure 4. Chizzola has reported a case of bronchial obstruction due to a foreign body in which mediastinal displacement and a non-opaque lung were recorded on the roentgenogram. No mention was made of further studies, so it is not known whether or not the transparency of the affected lobe was lost subsequently to be replaced by the usual extreme density of massive atelectasis.

It is probable that roentgenograms similar to Figure 3 have not previously been recorded for one of two reasons, namely: that this stage does not occur at any time in every case, or that when it does, the time between its occurrence and the subsequent appearance (Fig. 4) is so short that it has been missed, despite daily roentgenographic examination.

For these reasons, we believe that the findings in this case justified the diagnosis of pulmonary atelectasis and that this would explain the mediastinal displacement.

Most writers interested in massive atelectasis have been perplexed by the extreme density of the affected lung, and in this case its explanation is attended with the utmost difficulty, because coincident with it partial replacement of the mediastinal structures has occurred. A probable explanation for the extreme density is the retention of secretions in the obstructed lung after absorption of the imprisoned air. One of us (12) in 1924, entitled his first contribution to this subject, "Postoperative Massive Pulmonary Collapse and Drowned Lung," believing that retained secretions must be present within the collapsed lung to account for the extraordinary density on the roentgenogram. The large outpouring

of secretion which Lee and Tucker subsequently observed during bronchoscopic aspiration in a collapse attack and the equally abundant expectoration which frequently occurs spontaneously prior to re-expansion of the affected lung would seem to justify this original conception. That retained secretions account for some of the extraordinary density is reasonably sure; that they do not explain the picture entirely is equally obvious when it is remembered that neither massive pneumonia, in which the bronchioles and alveoli are filled with exudates, nor large empyemata, obscure the rib shadows so completely. In discussing this subject with Bowen (2) he stated that Sante has considered engorgement of the pulmonary vascular system a possible reason for the lung density. Bowen agrees with this explanation and is of the opinion that the engorgement of the pulmonary vascular system results from an increase in negative intrathoracic pressure on the affected side.

The intrapleural negative pressure increases as the volume of the affected lung diminishes; Elkin (7) and Habliston have recorded high negative intrapleural pressure readings in cases of massive atelectasis. Clinically, this altered intrapleural negative pressure produces diaphragmatic elevation, diminished intercostal spaces, shifting of the mediastinal structures to the affected side and compensatory hyperaeration (not emphysema) of the unaffected lobes.

If the increase in the negative intrapleural pressure can produce these changes, it is plausible to suppose that engorgement of the pulmonary vascular system would readily occur.

While it is probable that engorgement of the pulmonary vascular system occurs for the reason above stated, it cannot alone be responsible for the extreme density of the affected lung because the heart, thick walled and filled with blood, is less dense than the usual pulmonary shadow.

SUMMARY AND CONCLUSIONS

Fully cognizant of the fact that we are adding together some fact and much theory in an attempt to explain this unusual case, we offer the following conclusions:

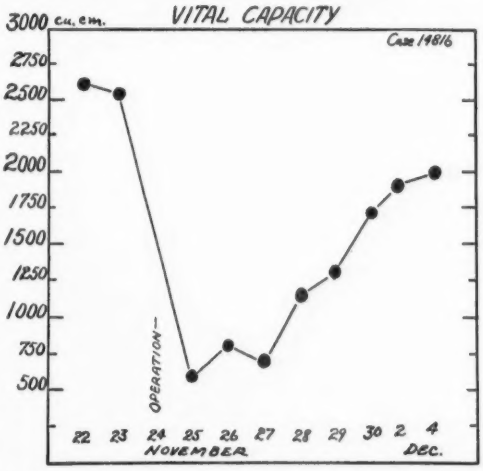

Fig. 6. Graph showing vital capacity readings made before and after operation. The ordinary clinical spirometer was used. The highest of three tests was recorded in each instance.

1. The first roentgenogram made after operation is an example of pulmonary atelectasis despite the absence of extreme roentgenographic density characteristic of this disease.

2. The slight haziness of the affected lung is due to atelectasis and vascular engorgement of the pulmonary vessels, produced by an increased intrapleural negative pressure. Of all of the compensatory mechanisms reacting to increased intrathoracic, negative pressure, one would expect that vascular engorgement would be the first to respond. That increased negative intrathoracic pressure exists is evidenced by mediastinal displacement, diaphragmatic elevation, and narrowed inter-rib spaces.

3. The usual picture of massive atelectasis results from retained secretions in the affected lung (drowned lung) plus vascular engorgement.

4. No explanation is offered for the fact that at the time of the maximum lung density, the mediastinal structures had partially returned to their normal position, unless we assume that in Figure 3 the entire right lung was atelectatic and that in Figure 4 the right upper lobe had re-expanded. Were this the case, the reduction in the amount of negative pressure, incident to the re-expansion of the

upper lobe, would lessen the degree of mediastinal displacement. Whether or not this actually occurred cannot be determined with certainty despite careful study of the roentgenograms.

5. The absence of fever at the time of the most marked atelectasis and its appearance coincident with the maximum lung density argues in favor of the contention of one of us (7) that fever and leucocytosis are brought about by the absorption of retained secretions.

6. The paucity of pulmonary symptoms, the absence of signs of pulmonary insufficiency and the lack of cough or sputum are most unusual but not unique. The absence of sputum is not necessarily a valid argument against our conception of the mechanism of this postoperative complication: bronchial obstruction, retained secretions, and drowned lung. It is probable that considerable absorption of exudates may occur in this condition, just as it does in lobar pneumonia in which complete lobar resolution may occur without any expectoration whatever.

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CHOLELITHIASIS IN THE KOREAN[1]

A. I. LUDLOW, M.D., F.A.C.S., SEOUL, CHOSEN (Korea)

Mayo Foundation Lecture, January 24, 1928

ONE of the aims of the physician in Korea is to investigate the medical problem of a people that differ in diet, customs, and habits from people in other countries. Much has been written in America and Europe on the subject of gall stones, but so far as I am aware no report has been published concerning the incidence of cholelithiasis among Koreans.

HISTORICAL REFERENCE

The Tong Wee Paw Kam, "A Valuable Treatise on Oriental Medicine," was written in 1777 A.D., at the request of the king, by a Korean named Haw Choon. This book is regarded by native doctors as a most reliable source of medical and surgical information. The only statement found in this book concerning the gall bladder is that "the organ is related to the lung in function but has no outlet." Inasmuch as in former times there were no autopsies or dissections in Korea, human gall stones were obtained only when passed in the fæces, but the organ in which they originated was unknown.

Koreans apply the term "In Whang," literally "Man Stone," to gall stones from the human body. The Koreans of olden times and some of the present day placed a high value upon the bile from the bear and considered the human gall stone as the most potent medicine known to man.

INCIDENCE OF CHOLELITHIASIS

In 1912, when I first came to Korea, Eastern medicine was still in its initial stage. Statistics were fragmentary and had to be accepted with great caution. Under such circumstances, the question of the incidence of surgical diseases brought forth many conflicting opinions.

Appendicitis and cholelithiasis were conceded to be of infrequent occurrence. In the light of later experience, however, appendicitis was found to be fairly common. Rodman states: "Appendicitis is either on the increase in nearly every country and with every race or its recognition has been made easier with both the profession and the laity." The latter part of Rodman's observation is true for Korea.

Cholelithiasis, on the other hand, seemed to show no increase in occurrence, although its recognition also should have been made easier with the advance of medical knowledge in Korea. In order to determine as accurately as possible whether or not the above impression was correct, a questionnaire was sent to physicians in charge of mission hospitals, located in all parts of the country. Replies were received from 12 hospitals. During the year 1925 there were 6,658 in-patients and a total of 3,497 general operations of which 540 were laparotomies. Only 3 of these operations were for gall stones. Five of the doctors, who had been in Korea from 10 to 20 years, recorded a total of only 15 operations in which gall stones were found. Biggar, of Pyengyang, Korea, reported a case in which a gall stone, 5 centimeters in length and 2 centimeters in diameter, was found in the common duct. The stone was soft and broke while it was being removed. Imbedded in the center of the stone were two perfectly formed pine needles. The common duct also contained an ascaris.

Investigation was next made of our own records. The distribution of the cases of cholelithiasis in Severance Hospital, according to time, is indicated in Table I which gives the ratio of the number of cases of gall stones to the number of in-patients, to the number of general operations, and to the number of laparotomies performed during the same periods.

Of the 8 patients reported in Table I, gall stones were found in 4 males (2 patients with stones in gall bladder and 2 with stones only in the common duct); and 4 females (1 with stones in the ducts of the gall bladder and in the liver; and 3 with stones only in the common duct). One of the last group of cases is worthy of special mention.

[1]Article No. 45. Research Department, Severance Union Medical College.

TABLE I.—DISTRIBUTION OF CASES OF CHOLELITHIASIS AT SEVERANCE HOSPITAL

Year	No. cases gall stones	No. of hospital patients	Ratio	No. general operations	Ratio	No. of laparotomies	Ratio
1916	1	1,128	1:1,128	511	1:511	43	1:43
1917	2	1,290	1: 645	641	1:320	46	1:23
1918	1	1,680	1:1,680	569	1:569	34	1:34
1919	1	2,358	1:2,358	693	1:693	50	1:50
1920	0	1,970		670		53	
1921	1	1,883	1:1,883	831	1:831	72	1:72
1922	1	2,033	1:2,033	732	1:732	147	1:147
1923	1	1,971	1:1,971	800	1:800	129	1:129
1924	0	2,097		777		119	
1925	0	2,135		791		130	
1926	0	2,086		790		123	
Total	8	20,625	1:2,578 (0.039%)	7,805	1:975 (0.102%)	946	1:118 (0.846%)

The patient, a woman, aged 35 years, was operated upon on June 24, 1918. The right lobe of the liver was found to be enlarged to the level of the umbilicus, and the gall bladder was bound to the duodenum by adhesion. The gall bladder was almost completely filled by two calculi, one shaped like the gall bladder (8 by 4 centimeters) and the other a round stone (2 by 2 centimeters), which fitted into a facet in the large stone. A mass of smaller stones was found in the cystic, common and hepatic ducts. Two stones, about 1 centimeter in diameter, were palpated in the liver substance and were removed through a dorsal incision into the liver. The common duct was closed and the gall bladder was drained. The patient made a good recovery and was dismissed from the hospital on August 31, 1918.

In another patient, there was a stone measuring 8 by 5 centimeters, the largest we have ever seen in the common duct.

None of our patients with gall stones was under 30 years of age. However, Rogers of Soonchun (Junten), Korea, recently reported the case of a Korean, male, aged 18 years, who had several small stones in the gall bladder and one measuring 3 by 2 centimeters in the common duct. The stone in the common duct was brownish-yellow in color, and was so soft that it crumbled on being removed.

COMPARATIVE RACE INCIDENCE OF CHOLELITHIASIS

Considerable difficulty was encountered in making a comparison of the incidence of cholelithiasis among Koreans with that among people of other races. Inasmuch as China has been related so closely to Korea for many centuries, an effort was made to find out something concerning the incidence of gall stones in the former country. On account of the recent disturbances, reports were obtained from only 7 institutions but these hospitals represent widely separated sections and are among the largest in China.

TABLE II.—SUMMARY OF THE CLINICAL CASES OF CHOLELITHIASIS IN KOREANS

Year	Hospital	No. cases of gall stones	No. hospital patients	Per cent	No. general operations	Per cent	No. of laparotomies	Per cent
1925	12 Missions (outside Seoul)	3	6,658	0.045	3,497	0.086	540	0.555
1916 to 1927	Severance	8	20,625	0.039	7,805	0.102	946	0.845
	Total	11	27,283	0.040	11,302	0.097	1,486	0.740

Mole, of Moukden (Manchuria), found gall stones to be of rare occurrence, as during the year 1925 there was no case among 2,115 in-patients. In Moukden it has been difficult to obtain autopsies, only 25 having been performed in the past 15 years and among them no gall stones were found.

Van Gorder, of the Peking Union Medical College, reported that in the year 1925 there were 2,885 Chinese in-patients on all services. Among the 752 Chinese surgical in-patients, 5 cholecystectomies were performed, only one of which was for gall stones; while among 137 foreign in-patients, there were 4 cholecystectomies, 3 of which were for gall stones. Previous to the year 1925, 15 cholecystectomies were performed on Chinese patients, only 4 of which were for gall stones, while among foreign patients, 17 cholecystectomies were performed, 11 of which were for gall stones. During the year 1925, the pathological department of the Peking Union Medical College recorded 65 autopsies upon Chinese patients, and gall stones were found in 3 cases. In 8 autopsies upon foreigners, no gall stones were found. The total number of autopsies upon Chinese previous to 1925 was 119, gall stones being found in 3 cases. The total number of autopsies upon foreigners previous to

1925 was 21, among which no gall stones were found. Stearns, of Tsinan, found no case of gall stones among 1,450 in-patients during the year 1925. From 1924 to 1926 inclusive, 76 autopsies were performed, about half the number being on children, and no case of gall stones was found.

Dunlap, of the Temple Hill Hospital, Chefoo, reported no case of gall stones among 650 in-patients during the year 1925.

Hutcheson, of Nanking, among a total of 3,291 in-patients at the University Hospital in 1925, stated that in 2 cases a diagnosis of gall stones was made but neither patient was operated upon. However, within the 3 months from January to March, 1927, he operated upon 2 patients with common duct stones.

Oldt, of the Canton Hospital, recorded only one case of gall stones during the years 1921 to 1923 inclusive, although there were 9,717 in-patients and 5,545 general operations, of which 330 were laparotomies. It is of interest to note that 140 operations for vesical calculi were performed during this same period. No autopsies were reported by Oldt.

Hofmann, of the David Gregg Hospital (Women's Hospital), Canton, found no case of cholelithiasis among 2,600 in-patients and 929 general operations, most of which were gynecological, though vesical calculi are common in this hospital. In 10 autopsies, no gall stones were found.

The statistics reported in Table III indicate that gall stones are very rare among the Chinese, but the vast population of China, with its meager hospital facilities and comparatively few qualified physicians, would make it seem possible that the incidence of gall stones in the Chinese may be greater than is indicated by these statistics.

A comparison of the incidence of cholelithiasis among the Koreans with that among the people of other races is shown in Table IV.

The incidence of gall stones among the American in-patients and among general operations is thirty times that found among Koreans, but the incidence based on the number of laparotomies is only ten times greater among Americans than among Koreans.

Among all the above races combined, the percentage of gall stones is as follows: In-patients, 0.535; general operations, 1.120; and laparotomies, 6.179.

TABLE III.—SUMMARY OF CLINICAL CASES OF CHOLELITHIASIS IN THE CHINESE

Year	Location of hospital	No. case of gall stone	No. of hospital in-patients	Per cent	No. general operations	Per cent	No. of laparotomies	Per cent
1925	Moukden	0	2,115		1,110		49	
1925	Peking	1	2,885	0.035	2,541	0.039	387	0.258
1925	Tsinan	0	1,450		589		32	
1925	Chefoo	0	650		330		28	
1925	Nanking	0	3,291		1,217		35	
1921–1925	Canton	1	9,719	0.010	5,545	0.018	330	0.303
1925	David Gregg, Canton	0	2,600		929	00	?	
Total	7 hospitals	2	22,710	0.009	12,270	0.016	861	0.232

AUTOPSY INCIDENCE OF CHOLELITHIASIS AMONG THE KOREANS

No autopsies were reported from any of the mission hospitals in Korea outside of Seoul. In the Severance Union Medical College, from the year 1912 to 1926, inclusive, there were 150 autopsies, among which gall stones were found in only 3 cases, an incidence of 2 per cent.

The first patient was a male, 56 years of age, in whom two faceted stones, 1 and 2 centimeters in diameter, respectively, were found in the common duct. The second patient was a man 59 years of age, in whom the gall bladder was distended with black bile and the cystic duct closed by a soft, elliptical, non-faceted stone, beside which some of the remains of much macerated ascaris was found. The rest of the worm had passed down into the common duct and had associated itself with a larger, soft, non-faceted stone, 4 by 1½ centimeters in diameter. In the third patient, a male, 38 years of age, reported by my colleague, Dr. S. H. Shim, a brownish-black, soft stone was found in the common duct. The stone, which was broken in the process of removal, contained the remains of an ascaris in its center.

The pathological department of the Government Keijo Medical College (8) reported 125 autopsies upon Koreans during the years 1914 to 1926 inclusive. In this series gall stones were found in 4 males whose respective ages were 26, 46, 46, and 68 years; and in one

TABLE IV.—COMPARATIVE RACE INCIDENCE OF CHOLELITHIASIS, BASED ON CLINICAL STATISTICS

Reported by	Race	No. cases gall stones	No. hospital patients	Per cent	No. general operations	Per cent	No. of laparotomies	Per cent
Lankenau Hosp. (1921–1925)		452	21,380	2.114	12,093	3.738	8,456	5.345
Mayo Clinic (1925)	American	763	66,959	1.139	25,730	2.965	8,147	9.365
Lakeside Hosp. (1925)		34	6,688	0.508	4,886	0.696	659	5.159
	Total	1,249	95,027	1.314	42,709	2.924	17,262	7.235
Valdes	Mexican	27	10,317	0.262	1,925	1.400	632	4.272
Ludlow	Korean	11	27,283	0.040	11,302	0.097	1,486	0.740
Wanless	Indian	4	2,961	0.135	4,640	0.086	686	0.583
Ludlow	Chinese	2	22,710	0.009	12,270	0.016	861	0.232
	Total	1,293	158,298	0.817	72,846	1.775	20,927	6.179
			Data incomplete					
Bloch	American	6			3,203	0.187		
Alden	Negro	9	23,016	0.035				
Walton	British	409			76,410	0.535		
Scheult	West Indian	11	64,126	0.017				
	Trinidad							
Grand total	In-patients	1,313	245,440	0.535				
	General operations	1,708			152,459	1,120	20,927	6.179
	Laparotomies	1,293						

female, 64 years of age. The total represented only 4 per cent of the cases. In this same institution, there were 96 autopsies on Japanese during the same period. Among these, gall stones were found in 2 males, 44 and 53 years of age, respectively; and in 2 females, 53 and 69 years of age, respectively, these 4 cases being 4.25 per cent of the total.

A comparison of the autopsy incidence of cholelithiasis among Koreans with that among people of other races was made. While on furlough, through the courtesy of Drs. Harry Goldblatt and A. R. Moritz, I examined the records of 3,000 autopsies (February 2, 1898, to June 2, 1927) from the Pathological Department of Lakeside Hospital, Cleveland, Ohio. In this series, there were 2,800 complete autopsies, a summary of which is presented in Table V.

An analysis of Table V shows results similar to those reported by Mosher, the percentage of gall stones among the above 2,800 autopsies being 6.54 as compared with 6.94 among the 1,655 autopsies recorded by Mosher. Our American series confirms former observations, namely:

1. The frequency of gall stones increases with the age of the patient examined, and their incidence is rare before the age of 20 years.

2. Gall stones are found more frequently in the white race than in the black race. Our series shows an incidence of 6.97 per cent among whites and 4.32 per cent among negroes. Mosher found 7.85 per cent among whites and 5.51 per cent among the negroes. Alden reports only two cases of gall stones among 696 autopsies which he performed on negroes in the Grady Hospital.

3. In our series, gall stones are found more frequently among females than among males. The frequency of gall stones in 1,066 females was 8.44 per cent and among 1,734 males, 5.36 per cent. Mosher found the incidence of gall stones among 618 females to be 9.37 per cent and among 1,037 males, 5.94 per cent.

In support of the apparent infrequent occurrence of cholelithiasis among Koreans, a few factors deserve mention:

1. *Outdoor life.* As stated above, most of the Koreans are farmers and it is probable that at least 80 per cent of the people lead an outdoor life.

2. *Constipation.* While we cannot offer exact information as to the occurrence of constipation, it is the opinion of my Korean

TABLE V.—AUTOPSY INCIDENCE OF CHOLELITHIASIS, BASED ON RECORDS OF LAKESIDE HOSPITAL

White

	Male			Female			Total		
Age years	No. of autopsies	No. of gall stones	Per cent	No. of autopsies	No. of gall stones	Per cent	No. of autopsies	No. of gall stones	Per cent
0–10	255	0	0.00	183	0	0.00	438	0	0.00
11–20	72	1	1.39	42	0	0.00	114	1	0.88
21–30	188	6	3.19	141	9	6.38	329	15	4.56
31–40	285	7	2.45	187	15	8.02	472	22	4.66
41–50	294	21	7.14	141	22	15.60	435	43	9.89
51–60	212	21	9.90	78	11	14.10	290	32	11.03
61–70	133	21	15.79	60	15	25.00	193	36	18.65
71–80	45	8	17.77	12	4	33.33	57	12	21.05
81–90	4	0	0.00	5	2	40.00	9	2	22.22
91–100	0	0	0.00	0	0	0.00	0	0	0.00
Total	1,488	85	5.71	849	78	9.19	2,337	163	6.97

Negro

	Male			Female			Total		
Age years	No. of autopsies	No. of gall stones	Per cent	No. of autopsies	No. of gall stones	Per cent	No. of autopsies	No. of gall stones	Per cent
0–10	34	0	0.00	41	0	0.00	75	0	0.00
11–20	10	0	0.00	12	0	0.00	23	0	0.00
21–30	55	0	0.00	57	0	0.00	112	0	0.00
31–40	70	2	2.86	58	4	6.89	128	6	4.69
41–50	34	2	5.88	27	4	14.81	61	6	9.83
51–60	33	3	9.09	15	3	20.00	48	6	12.50
61–70	5	1	20.00	4	1	25.00	9	2	22.22
71–80	4	0	0.00	2	0	0.00	6	0	0.00
81–90	0	0	0.00	0	0	0.00	0	0	0.00
91–100	1	0	0.00	0	0	0.00	1	0	0.00
Total	246	8	3.25	217	12	5.53	463	20	4.32
Grand total	1,734	93	5.36	1,066	90	8.44	2,800	183	6.54

associates that constipation is less frequent among the Koreans than among Westerners.

3. *Diet.* The Koreans are mainly vegetarian in their diet. "Rice is the great staple, millet and barley being frequently substituted for it in whole or in part, especially in North Korea; peas and beans are often mixed with the rice and are otherwise important articles of food. Vegetables are eaten in some form at every meal. Fruits do not form an important part of the diet though there has been an increase in recent years. Meat is not much eaten by the poorer classes, but those who can afford it eat a fair amount. Fish is eaten in great quantities, especially when salted or dried. All eat some eggs and little poultry. Milk, butter, and cheese are rarely used." More milk is now being used than was formerly the case. Van Buskirk (18) has summarized 79 diet lists, each reporting all the food consumed for one month, furnished by 42 different Koreans from various classes of people—students, office-workers, merchants, apprentices in laboratory and drug-room, farmers, laborers, and housewives. The average daily consumption for all, both men and

TABLE VI.—COMPARATIVE RACE INCIDENCE OF CHOLELITHIASIS, BASED ON AUTOPSY REPORTS

Reported by	Race	No. of autopsies	No. cases of gall stones	Per cent	Total per cent
Schrœder	German	1,150	141		12.26
Mitchell	Swiss	16,025	1,714		10.70
Mitchell	Austrian	19,974	1,557		7.80
Mentzer	American	612	123	20.09	
Opie		125	16	12.80	
Mosher		1,018	80	7.85	
Ludlow		2,337	163	6.97	
Mitchell		1,473	48	3.24 C	oroner's
Rodman		1,050	31	2.86 c	ases
American	Total	6,615	461		6.97
Ludlow	British	20,851	835		4.00
Mosher	Negro American	634	35	5.52	
Ludlow		463	20	4.32	
Mitchell		122	2	1.64	
Alden		696	2	0.29	
Negro	Total	1,915	59		3.08
Gov. Hosp. (Keijo)	Japanese	96	4	4.16	
Miyake		8,406	258	3.07	
Japanese	Total	8,502	262		3.08
Gov. Hosp. (Keijo)	Korean	125	5	4	
Ludlow		150	3	2	
Korean	Total	275	8		2.91
Van Gorder	Chinese	155	6	3.86	
Stearns		76	0	0	
Mole		25	0	0	
Hofmann		10	0	0	
Chinese	Total	266	6		2.25
Clark	(West Indian) Negro Canal Zone	1,088	24		2.21
Scheult	West Indian Trinidad	7,557	5		0.07
	Grand total	84,218	5,072		6.02

women, was as follows: protein, 82.1 grams; lipins, 20.3 grams; carbohydrates (by dif.), 523 grams—or a total food value of 2,608 calories. The amount of Vitamin A is doubtful.

The average amount of cooked rice and of rice mixtures was 1,725 grams a day for men and women, the women eating somewhat less than the men. This is about the equivalent of 575 grams of dry rice—a very great bulk. "Kimchi," the Korean pickle, so commonly eaten, is also bulky, so that the total bulk of the diet is greater than can well be digested.

The protein utilization is only between 70 and 80 per cent. This is in accord with the findings of McKay, in India, and of the Japanese investigators. Animal protein furnished on the average only about 22 grams a day. The amount of "fats" a day is only 20.3 grams—a very small amount in comparison with Western standards.

From observations among the natives of Java, China, Japan, and India, De Lange found that the cholesterol content of the blood and bile averaged 40 to 50 per cent less than that in Europeans. No observations have yet been made upon the Korean, but we hope that this will be done in the near future. Mentzer observes "that the low fat value of the food is concerned with the low lipoid content of the blood and bile, which is an inhibitory factor in the formation of the cholesterol 'common' stone. Gall stones have been produced experimentally in animals simply by excessive fat feeding. Disturbance of cholesterol metabolism of the body generally, or of the gall-bladder wall locally, with the resultant increase in the cholesterol content of bile, is probably a primary factor in the formation of gall stones." If this theory proves to be correct, then it may account for the rarity of the cholesterol stone among Koreans as well as among the Japanese and other races classified as herbivorous. Only one cholesterol stone was found in our series of 8 cases.

There are certain considerations, on the other hand, which must be considered before any conclusions are drawn as to the infrequency of cholelithiasis among Koreans:

1. *Few hospitals and physicians.* The Korean population is approximately 19,000,000. According to the official returns at the end of 1925, the total number of hospitals in Korea was 107, including: 27 Government institutions, 10 public hospitals; and 70 private hospitals, of which 37 are Japanese, 11 Korean, and 22 foreign, mission, and mine hospitals. The same returns put the number of regular physicians at 1,281. Many of the hospitals are small and most of them are in the larger centers of population. As 80 per cent of the population is farmers, it is evident that few of the country people receive hospital care.

2. It is fair to assume, from our experience with other surgical lesions, that only patients with severe cholelithiasis would consult a physician and that the physician would often give

the patient medical rather than surgical treatment. It is significant that 5 of our 8 patients had common duct stones.

3. *Laparotomies.* Infections, osteomyelitis, empyema, fistulæ-in-ano, hæmorrhoids, tuberculosis, and injuries constitute a large part of the surgical work in Korea. Of late years, abdominal surgery has increased so that, at the present time, laparotomies amount to about 15 per cent of the total number of general operations; this percentage is about one-half of that for ten American hospitals.

4. *Sex.* In Western countries, gall stones are much more frequent in the female. In his series of 1,000 cases of cholelithiasis, McGuire (9) found that 71 per cent were in females. Deaver and Bortz report 327 females and 125 males in a series of 452 cases of calculous cholecystitis. In our series, there were equal numbers of males and females, but this can be explained, at least in part, by the fact that male patients predominate in Severance Hospital, in 1 year there being 1,280 males and 720 females among 2,000 patients.

5. *Age.* In the series above mentioned, Deaver and Bortz record 187 patients below, and 265 above, the age of 40 years. As 80 per cent of our patients are under the age of 40 years, we do not expect to find many cases of gall stones.

6. *Multiparæ.* Gall stones are more common among multiparæ of other nationalities. If this is an important predisposing cause, then the Korean should be especially predisposed to gall stones, for statistics recently published by Van Buskirk and Mills (19) show 20,454 births among 5,000 Korean women. In the same series, the average number of children for each woman over 45 years of age was 5.7.

7. *Infection.* Infection has been regarded by many authorities as one of the chief factors in the causation of gall stones. What a fertile soil Korea affords for infection, both bacterial and parasitical! Infections of all kinds furnish the surgeon with a large percentage of his patients. Intestinal parasites, chiefly trichuris trichiura, ascaris, ankylostomas, amœba and tænia are frequently present. Among 100 surgical patients, trichuris was present 95 times; ascaris, 60 times; ankylostoma, 49 times; tænia, 10 times; and trichastrongalus orientalis, 11 times. Eight patients had 4 varieties of parasites, 28 patients had 3 varieties, 4 had 2 varieties and 12 patients, 1 variety.

8. *Autopsies.* The autopsies thus far performed are too few in number to warrant any positive statement as to the frequency of gall stones among Koreans, but these examinations reveal the absence of any racial peculiarities in the anatomy of the biliary passages.

Present statistics show that cholelithiasis is of less frequent occurrence among Koreans than among the Occidental races, but in view of the above mentioned factors, future investigations will doubtless reveal an increased incidence of the disease.

SUMMARY

1. The Korean, for centuries, regarded the gall bladder as related to the lung in function, but thought it to be an organ without an outlet.

2. Although the Korean recognized the existence of gall stones in the human body and valued them highly as a medicine, until modern times, he was ignorant of their exact source.

3. The clinical statistics of Severance Hospital, for the years 1916 to 1926 inclusive, show 8 cases of gall stones, an incidence of 0.039 per cent among 20,625 in-patients; of 0.102 per cent among 7,805 general operations; and of 0.845 per cent among 946 laparotomies. Including all Korean statistics, there were 11 cases of gall stones, an incidence of 0.040 per cent among 27,283 in-patients; of 0.097 per cent among 11,302 general operations; and of 0.740 per cent among 1,486 laparotomies. Among all races combined, the incidence of gall stones is as follows: among in-patients, 0.535 per cent; among general operations, 1.120 per cent; and among laparotomies, 6.121 per cent.

4. In the Severance Union Medical College, in the years 1912 to 1926, inclusive, there were 150 autopsies. Gall stones were found in only 3 cases or 2 per cent. Including all Korean statistics, there were 275 autopsies, with gall stones in 8 cases or 2.91 per cent, as compared with 6.07 per cent for other races.

5. In explanation of the apparent infrequency of gall stones in the Korean, the following factors may be cited: (1) outdoor life; (2) comparative freedom from constipation; and (3) a diet which is largely vegetarian and low in fats.

6. In view of the following considerations it would be hazardous to claim that cholelithiasis is as rare in the Korean as our statistics would seem to indicate: (1) the large number of people in Korea who, except for the most serious lesions, rarely consult a qualified physician or surgeon, of whom there are comparatively few; (2) the preference of the patient and often of the doctor for medical treatment; (3) the comparatively small number of laparotomies; (4) the predominance of male over female patients; (5) the age of the in-patients, 80 per cent being under the age of 40 years; (6) the large number of multiparæ; (7) the prevalence of infection, both bacterial and parasitical; (8) the small number of autopsies and the absence of racial peculiarities in the anatomy of the biliary structures.

7. When Korea is supplied with more and better qualified physicians, future investigations will doubtless prove that cholelithiasis is more frequent among Koreans than is shown by our present statistics. The same will, no doubt, be true of the Chinese.

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DUODENAL AND GASTRIC ULCER, CHOLECYSTITIS, AND APPENDICITIS: A CONSIDERATION OF THEIR PATHOLOGICAL RELATIONS[1]

J. W. LARIMORE, M.D., ST. LOUIS, MISSOURI
From Departments of Medicine and Radiology, Service of Gastro-Enterology, Washington University Medical School

THE alimentary abdominal organs are co-ordinated in their functions. Disease in one part or member of the tract will disturb more or less, and in a variable manner, the functions of the others. This pathological process may involve other abdominal organs. The occurrence of hepatitis with cholecystitis and the etiological relation of gall-bladder disease to pancreatitis are asserted frequently in the literature. Of alimentary, organic, and inflammatory disease, appendicitis, cholecystitis, and peptic ulcer, gastric and duodenal, are the most frequent, and together entail the greatest hazard to life and health of all alimentary disease. The coincidence of cholecystitis and of peptic ulcer or of both with appendicitis repeatedly occurs in clinical laparotomy and autopsy records. The association has ceased to create surprise. The question as to the primary, the secondary, or the independent position of these associated diseases is not readily answered. That there is a sequential relation is asserted by surgeons of respected authority (Moynihan, Deaver, Trotter) whose experience encompasses the clinical recognition and the development of the diagnosis and surgery of these diseases. The occurrence of peptic ulcer and of cholecystitis in patients who have previously had an appendectomy also raises the question of pathological sequence. This question is generally as quickly lost in the current condemnation of the prevalence of appendectomy for chronic appendicitis. This is commonly assigned a clinical failure of 40 per cent. This failure is, in most instances, asserted because the patient returns subsequently for continued or other abdominal symptoms. In the light of the definite coincidence of chronic disease of the appendix with other abdominal disease, the record of such clinical failure from unassociated appendectomy does not justify the conclusion that the failure is due solely to an error of diagnosis.

Characteristic morbidity liabilities are recognized for the succeeding decades of life. The difference and the overlapping of the age incidence of associated diseases is not recorded. Heinrichsen complains of the lack of statistical material for the association of the abdominal triad. In a general summary of cases, the following analysis of the relations of the age incidences of these diseases seemed of interest in considering their pathological relations.

The material consists of a consecutive series of 4,742 complete gastro-enterological studies during 4 years. The cases of appendicitis, duodenal and gastric ulcer, and of cholecystitis, clinically and roentgenologically diagnosed, with many operative confirmations, have been reviewed to determine the incidence of association and their related age incidence. There are considered: 345 cases of ulcer, 414 cases of cholecystitis with 194 cholecystectomies, and 542 instances of appendiceal disease with 110 unassociated appendectomies and 248 associated appendectomies. They have occurred during 4 years since the development of cholecystography. They were received from the university out-patient gastro-enterological service, from the free and private divisions of the hospital medical and surgical services, and from private office practice. They constitute a natural and representative selection of cases from an urban community. Reserving for another time a discussion of the entity of chronic appendicitis, of the roentgenological contributions to its diagnosis, and of the benefits of surgical interference, the assertion of these premises hardly needs to be made.

Cholecystography has contributed to the diagnosis of cholecystitis in these cases. It was done very nearly entirely by the intravenous method. The cholecystitis cases are those from the material of Graham, Cole, Copher, and Moore, which received the associated study of serial gastro-intestinal roentgenology.

The age of the cases at the time of the examination, and not the anamnesis data as to the age of initial symptoms, has been used.

[1] Presented before the American Gastro-Enterological Association, May 6, 1929.

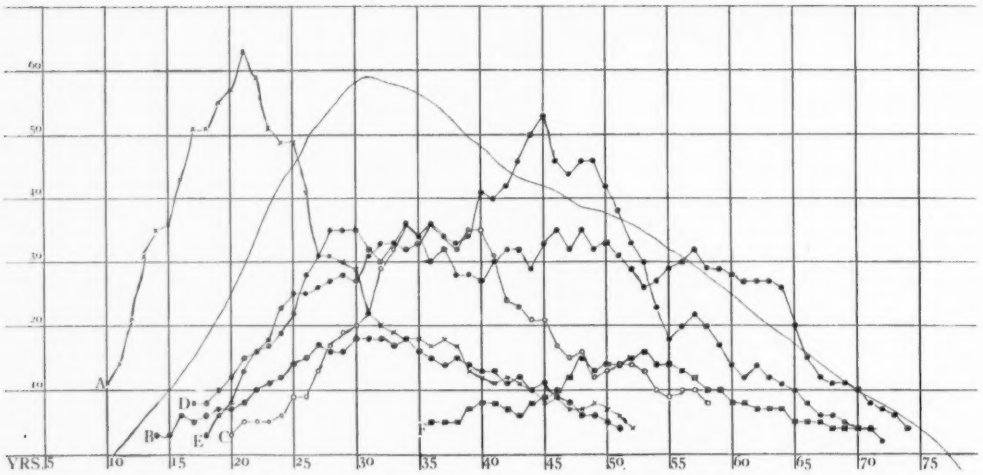

Chart 1. Demonstrates by age incidence curves, plotted from decennium incidence of actual occurrence, the relation of a group of unassociated appendectomies, *A*, and *B* of a group of appendectomies occurring previously in ulcer cases, to several groups of gastric and duodenal ulcers: group 1, *C*, the ulcers that have been preceded by appendectomy; group 2, *D*, those ulcers that have an associated pathological appendix; group 3, *E*, the ulcers that are unaccompanied by any signs of appendiceal disease; group 4, *F*, the triad of ulcer, cholecystitis, and appendiceal disease. The unbroken line shows the character (not the height) of the general incidence curve for all gastro-intestinal cases, and the variation in the character of the curves from this outline shows their departure from general age incidence.

The curves have been plotted from the decennium incidence determined yearly, and the end of that year (the fifth of the decennium) has been used as the mid-point of the decennium.

The cases considered in this paper, in which appendectomy had been performed, and in which ulcer or cholecystitis followed, were examined in most instances only at the time of the subsequent disease. They are a group naturally selected by the subsequent development of ulcer or cholecystitis. They are not representative of the group of 40 per cent of failures for appendectomy in chronic appendicitis. The anamnesis shows many to have been valid cases of acute or recurrent appendicitis.

The unassociated appendectomy cases received both clinical and roentgenological studies. Their age incidence has been determined to coincide with that of acute and subacute cases, which were operated upon after clinical examination alone. Operative confirmation in these cases, which had the combined studies, has justified reliance upon the help of the X-ray signs used.

The ulcer cases were fully studied and the final diagnosis was made upon the combined clinical, roentgenological, and laboratory evidence. Deformity of the duodenal bulb and unequivocal and characteristic change in the gastric contour were demonstrated in most of the cases.

Instances in which there was a coincidence of ulcer, cholecystitis, and appendiceal disease occurred in 4.9 per cent for all ulcers, 4.1 per cent for all cholecystitides. In all cases of associated ulcer and cholecystitis in which operation was done, the appendix gave positive evidence of present or past inflammatory disease. This association of the three localized inflammatory processes occurs late in life after the period of greatest frequency for ulcer and cholecystitis unassociated with each other.

Of the peptic ulcer group, 18 per cent have had a previous appendectomy; another 40 per cent show definite X-ray evidence of appendiceal pathology and the remaining 42 per cent yield no clinical or X-ray signs of appendiceal pathology, which does not, however, exclude it conclusively. Of cholecystitis cases coming to operation, 16 per cent have had a previous

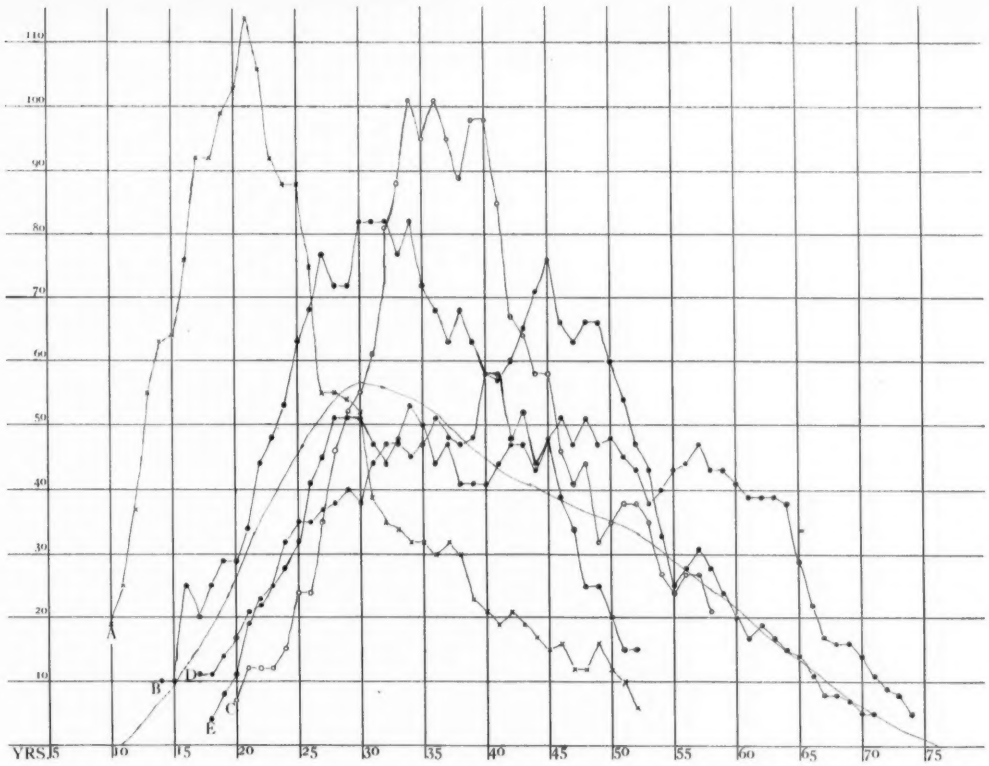

Chart 2. Demonstrates by age incidence curves, plotted by the decennium incidence of equal numbers of cases for each group, the relative segregation of these groups to different epochs. (See Chart 1 for curves of absolute incidence.) The appendectomies which preceded ulcers occur in the decade following unassociated appendectomies, and their incidence curve, *B*, does not reach its height until after the curve for simple appendectomies, *A*, has passed into its terminal decline. The peak of the curve for preceding appendectomies, *B*, and of that for ulcer having previous appendectomy, *C*, overlap and the latter curve persists for half a decade farther before dropping precipitately. It is followed half a decade later by a moderate peak in the curve, *D*, for the ulcers having an associated demonstrable pathological appendix. The curve for ulcers without associated appendiceal findings, *E*, shows little differentiation. The unbroken line characterizes the general incidence of all gastro-intestinal cases and the variation in the character of the curves from this outline shows their departure from general age incidence.

appendectomy. Of all the cholecystitis cases operated upon, another 60 per cent show a pathological appendix at operation and 24 per cent show a normal appendix. Of all the gall bladders shown to be pathological either by operative confirmation or by cholecystogram, 14 per cent have had a previous appendectomy, and another 50 per cent show a roentgenologically pathological appendix, and 36 per cent give no evidences of appendiceal pathology.

The appendectomies which have been followed by a pathological gall bladder, confirmed operatively or by cholecystogram, were performed after the peak of the age curve for unassociated appendectomies and show approximately the same age occurrence as for those appendectomies which preceded ulcer. The average priority of appendectomy in this association was, for the whole group, 9.7 years and was, for the two-thirds, 5.0 years. This, for the group, is a definitely longer interval than in the ulcer group.

Appendectomies which have been followed by ulcer have occurred chiefly in the years after the peak of the age curve for unasso-

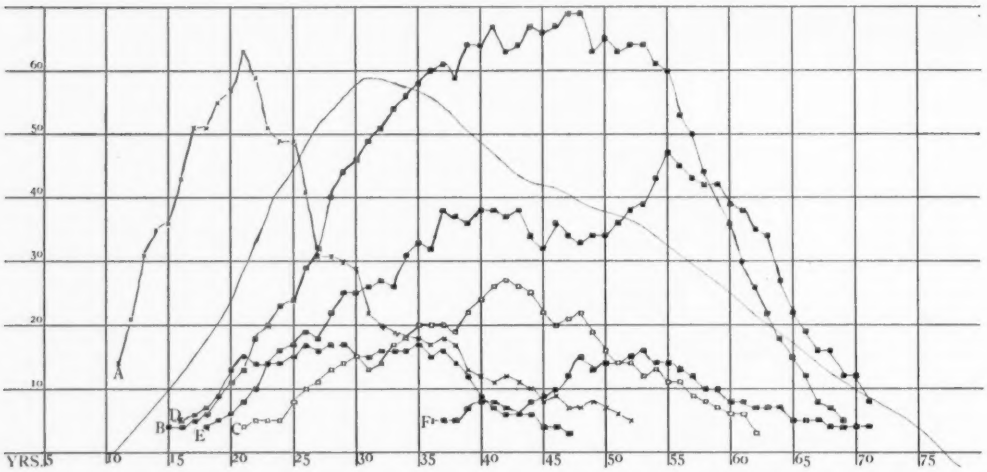

Chart 3. Demonstrates by age incidence curves, plotted from the decennium incidence of actual occurrence, the relation of a group of unassociated appendectomies, *A*, and *B*, of a group of appendectomies occurring previously in cholecystitis cases, to several groups of cholecystitis: group 1, *C*, the cholecystitis cases that have been preceded by appendectomy; group 2, *D*, those cholecystitis cases that have an associated pathological appendix; group 3, *E*, the cholecystitis cases unaccompanied by any findings of appendiceal disease; group 4, *F*, the triad of cholecystitis, ulcer, and appendiceal disease. The unbroken line characterizes the general incidence of all gastro-intestinal cases, and the variation in the character of the curves from this outline shows their departure from genera lage incidence.

ciated appendectomies and have averaged 7.6 years prior to my demonstration of ulcer and, for two-thirds of these appendectomies, the interval was 3.7 years.

There are in the curve of the residual group of those ulcer cases giving no appendiceal findings moderate peaks corresponding to those of the appendectomized (operated) group and pathological (diagnosed) group.

These associations do not necessarily signify anything other than coincidental disease. They do allow theoretical explanation on a basis of pathological processes.

DISCUSSION

The association of peptic ulcer and cholecystitis has been shown to have only a small percentage for the respective diseases. It has always occurred with associated appendiceal pathology. The frequent association of appendiceal pathology with each ulcer and cholecystitis, the differing total incidence of these two diseases in men and in women, and their associated occurrence only late in their separate age incidences tends to minimize their direct reciprocal etiological relationship.

The occurrence of 18 per cent of previous appendectomies in ulcer cases and of 14 per cent in cholecystitis entertains four interpretations: that there was originally an error in diagnosis; that the diagnosis was incomplete; that the subsequent disease was acquired independently, or as a sequel.

The charts have placed the group of appendectomized cases, naturally selected by having had subsequent upper abdominal disease, into the terminal portion of the incidence curve for simple appendectomy. Their curve of incidence lies between the curve for simple appendectomy and those for ulcer and cholecystitis. Do these cases represent originally mistaken diagnoses? Among them are by the anamnesis unmistakable cases of acute appendicitis and many valid chronic cases. A portion may have been complete errors. Do any of the valid cases represent at the time of the appendectomy an incomplete diagnosis? This is unanswerable. It is possible. Have these cases carried an appendiceal affection through and beyond the usual period of appendicitis, delaying or failing of operation until an abdominal infection is established which later localizes and manifests itself as ulcer or cholecystitis? The large percentage of cases of

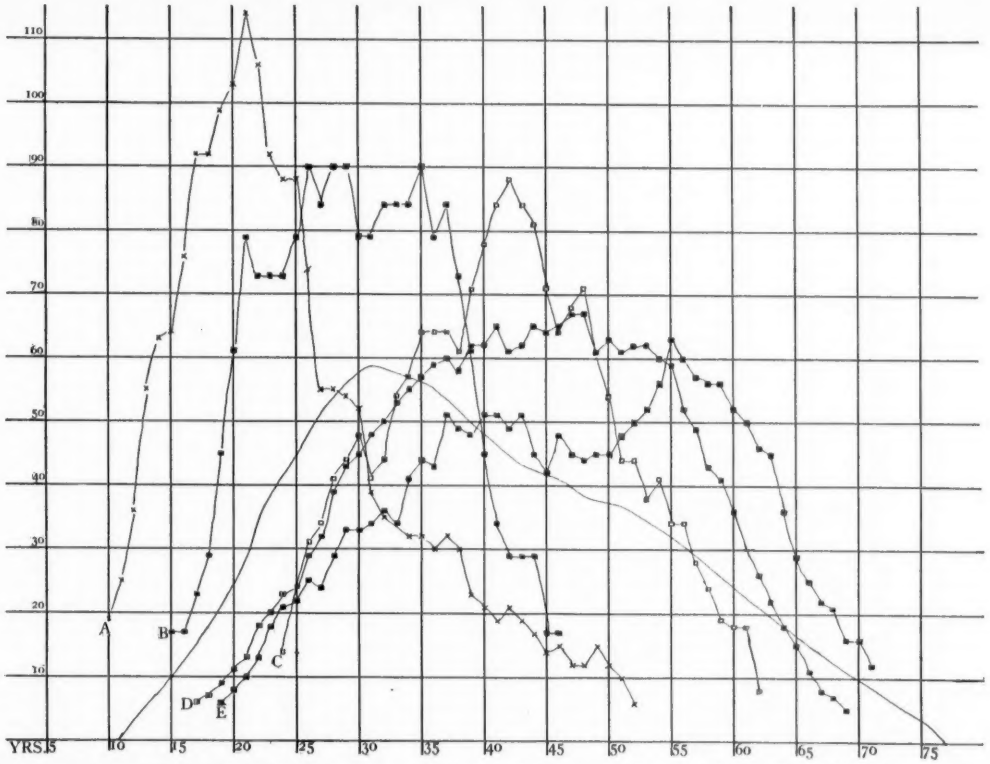

Chart 4. Demonstrates by age incidence curves, plotted from the decennium incidence of equal numbers of cases for each group, the relative segregation of these groups to different epochs. (See Chart 3 for curves of absolute incidence.) The appendectomies which preceded cholecystitis occur in the decade following unassociated appendectomies, and their incidence curve, *B*, does not reach its height until after the curve for unassociated appendectomies, *A*, has passed into its terminal decline. The prolonged peak of the curve for preceding appendectomies, *B*, precedes by half a decade the curve for cholecystitis having previous appendectomy, *C*. The curve for cholecystitis having an associated demonstrable pathological appendix, *D*, is a wide curve through the two middle decades (36–55) of life and reaches its height half a decade after the cases having preceding appendectomy, *C*. The curve for cholecystitis without associated appendiceal findings, *E*, is a broad low curve having a terminal peak more than half a decade later just before its precipitate decline. The unbroken line characterizes the general incidence of all gastro-intestinal cases, and the variation in the character of the curves from this outline shows their departure from general age incidence.

both ulcer and cholecystitis, occurring late in life, in which there is demonstrable change in the appendix, and in many of which there is both an associated history and roentgenological evidence of previous subacute or acute attacks, prompts an affirmative answer. Certainly it may be said that those appendectomies which occur late in the usual period of unassociated appendectomies, or rather those which, as seen on the charts, form the descent of the age incidence curve, are more likely to be followed by ulcer and cholecystitis. It is further noted that the occurrence of roentgenological signs of appendiceal disease in the presence of normal cholecystography diminishes reciprocally to the progressive increase with age of the occurrence of associated cholecystitis and appendiceal disease.

To attach greater significance to or to emphasize chronic disease of the appendix may be deprecated in the presence of the current critical discussion of appendectomy. This view of the relations of the appendix cannot be used to increase the indication for appendectomy. A conception, such as is suggested, of the large influence that appendiceal infec-

TABLE I.—SUMMARY OF 4,742 GASTRO-INTESTINAL CASES STUDIED DURING FOUR YEARS

	Male	Female	Total
Ulcer, cholecystitis, and appendiceal disease coincidental	11	6	17
Gastric	3	..	3
Gastric and duodenal	1	1	2
Duodenal	7	5	12
Ulcer and cholecystitis			
Without appendiceal findings	3	2	5
With previous appendectomy	5	2	7
Ulcer with previous cholecystectomy and appendectomy	4	2	6
Number of ulcers			
With previous appendectomy	40	30	70
Gastric	3	5	8
Duodenal	37	25	62
With associated pathological appendix	100	39	139
Gastric	13	9	22
Duodenal	87	30	117
Without appendiceal findings	102	34	136
Gastric	17	5	22
Duodenal	85	29	114
Totals	242	103	345
Gastric	33	19	52
Duodenal	209	84	293
Number of cases of cholecystitis			
With previous appendectomy			
Having cholecystectomy	8	23	..
Without operation	9	20	60
With associated pathological appendix			
At cholecystectomy	35	80	..
Without operation	32	58	205
Without appendiceal findings			
At cholecystectomy	12	36	..
Without operation	37	64	149
Totals	133	281	414
Unassociated appendiceal disease			
Having operation	32	78	110
*Unoperated upon	38	50	88

*Ulcer and cholecystitis absent by clinical and roentgenological examination.

tion plays in the development of other inflammatory abdominal disease, especially of cholecystitis and ulcer, can only force upon the clinician the necessity for all direct and eliminative diagnostic methods. Appendectomy, even when done upon a complete and accurate diagnosis, does not extirpate all the inflammatory process or remove the hazard of upper abdominal disease. Pathology is inherently progressive. The body defense mechanism may limit and stop it. The shift of ascendancy is a function of time in the self-limited diseases. In others, the progression is not so orderly and often surgical interference at the focus of the process is necessary. Extirpation of this point, as in appendicitis, does not remove all of its extensions. The control of these is not immediate, and the sequelæ of appendicitis may occur more or less remotely after appendectomy. Mistaken and incomplete diagnoses are not the necessary explanations for the so-called clinical failures, even if often applicable. It should not be inferred that the appendix is thought to be the sole source of infection for peptic ulcer and cholecystitis. It is believed that the position of the appendix as a frequent initial site for abdominal infection is in danger of being obscured by the reaction from hasty surgery of the appendix. Unfortunately, the usual technical ease of appendiceal surgery is disproportionate to the difficulties of adequate and certain diagnosis of the acute as well as the chronic disease.

SUMMARY

The statistical relation of ulcer, cholecystitis, and appendiceal disease in a large series of studies of gastro-intestinal cases has been determined, and the age incidence of their occurrence has been plotted to show their further relations. Appendiceal disease has been associated in the majority of ulcer and cholecystitis cases. Appendectomies have occurred prior to the finding of ulcer and cholecystitis in a significant percentage of the cases, and, by the anamnesis, have usually been done on a valid diagnosis. These appendectomies are shown to have occurred chiefly at a period later than is usual for unassociated appendicitis. Ulcer, cholecystitis, and appendiceal disease are, all three, concomitant in only a small percentage of cases. The relation of these facts as indicating an infectious etiological connection of the lesions in these sites is discussed. The need for both direct and eliminative findings in reaching a diagnosis of chronic appendicitis is emphasized.

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CLINICAL SURGERY

FROM THE CLINIC OF LORD MOYNIHAN

LEFT PARTIAL COLECTOMY

DIGBY CHAMBERLAIN, Ch.M., F.R.C.S., LEEDS, ENGLAND
Hon. Assistant Surgeon, General Infirmary, Leeds

GROWTHS in the left half of the large intestine may be resected, either after a preliminary cæcostomy if there has been any obstruction or at once if there has not been an acute attack. A colectomy with an anastomosis between the two ends should never be done when the colon proximal to the growth shows any evidence of obstruction, and even in the quiet cases it is an additional safeguard to drain the cæcum. It must be remembered that the bowel contents on the left side are solid and that any movement subjects the suture line to a considerably greater injury than on the right side of the colon, where it is only the liquid small intestine contents which pass through the opening.

When we are considering the amount of bowel which should be removed, we must bear in mind the local spread of the growth, the blood supply, and the lymphatic drainage. Carcinoma of the colon is a local disease in the large number of cases, it remains confined to the region of the primary growth and the neighboring glands almost always, and, even in cases coming to postmortem examination, only 14 per cent show any visceral deposits. The growth may appear to be small and abruptly limited, but in a case of this kind carcinoma cells have been demonstrated which have permeated the bowel wall 6 inches above the lesion.

The blood supply of the left half of the colon comes partly from the middle colic artery and from the branches of the inferior mesenteric artery. These vessels divide and the branches anastomose one with the other, a particularly free junction taking place between the middle colic artery and the ascending branch of the left colic artery (the anastomosis magna of Riolan). There is also a free anastomosis between branches of the left colic and the sigmoid arteries, forming an artery which has been called the marginal artery, which lies close up to the bowel wall and reaches from the splenic flexure to the lowest part of the sigmoid colon. The importance of this marginal artery has been demonstrated by Archibald who has shown that the blood it receives from the middle colic artery is sufficient to maintain the vitality of the descending and sigmoid colon after the inferior mesenteric artery has been ligated at its commencement. The superior hæmorrhoidal artery does not divide into branches which anastomose with the sigmoid arteries, and there is, therefore, no marginal artery below the lowest sigmoid vessel. Ligation of the superior hæmorrhoidal artery and the lowest sigmoid artery will result in gangrene of that part of the bowel supplied by those vessels. Ligation of the inferior mesenteric trunk above the lowest sigmoid branch will allow that vessel, supplied by the marginal artery, to convey blood into the superior hæmorrhoidal artery. This junction between the superior hæmorrhoidal artery and the lowest sigmoid artery Sudeck calls the "critical point."

The lymphatic vessels correspond closely with the arteries. Glands lie along the margin of the intestine, between it and the marginal artery, and also along the main trunks of the arteries, particularly at the points of bifurcation and of origin. In addition to this, lymphatic channels run from the splenic flexure and the descending colon toward the glands at the hilum of the spleen.

It may be laid down that for growths in the region of the splenic flexure, about one-third of the transverse colon and one-half or rather more of the descending colon should be removed. For growths in the descending colon, one-third of the transverse colon, the descending colon, and a small portion of the sigmoid flexure should be removed; for growths in the sigmoid flexure, the whole of that part of the colon together with the lower end of the descending colon should be excised.

PRE-OPERATIVE TREATMENT

The patient is kept in hospital for some days before the operation in order that his general health may be improved as far as possible. Sepsis

Fig. 1. The blood supply of the colon.

Fig. 2. Mobilization of the colon.

is dealt with if it is present and fluids are administered by means of a 5 per cent solution of glucose. If the condition is bad, a transfusion of blood is given. The diagnosis is confirmed by means of a barium enema, or a sigmoidoscope examination if the growth is low down. A general survey is made to locate any malignant deposits which would render the case inoperable. It is better not to give aperients, as they may precipitate an acute obstruction, but to rely on rectal lavage to empty the colon as far as possible.

THE OPERATION

Although it may be an advantage to place the patient in the Trendelenburg position when the growth is low down in the sigmoid colon, in most cases this is unnecessary and easy access may be had with the table flat. The anæsthetic of choice is nitrous oxide gas and oxygen reinforced from time to time with a little ether and a preliminary injection of morphia, scopolamine, and atropine. The abdominal wall is prepared by cleaning it with ether soap, followed by a solution of biniodide of mercury in spirit and then Harrington's solution. The sheets are put in position and the abdomen is opened by an incision over the left rectus muscle, that muscle being displaced outward. Before the peritoneum is incised the skin edges are protected by tetra cloths which are clamped to the edges of the wound. The incision should be about 8 inches in length and its site can be varied according to whether the growth is in the upper or lower part of the colon. The peritoneum is opened and after the growth has been found and examined the rest of the abdomen is searched for secondary deposits. The glands, the liver, the hilum of the spleen, the bottom of the pelvis, and the ovaries in the female are examined in turn and if this examination is satisfactory, the operation is proceeded with. It is not uncommon to find the omentum adherent to the growth and it may be necessary to divide the adherent part between double ligatures at this stage. The small intestine is then packed out of sight with hot mackintosh swabs and everything is covered but the part actually being dealt with.

The left edge of the wound is retracted by an assistant, and the bowel is pulled over to the right as far as possible, so as to put the peritoneum on its outer side on the stretch. The peritoneum is then incised about 1 inch outside the colon, the incision extending along the whole length of the colon to be removed and extending through the costocolic ligament in those cases in which the splenic flexure is to be removed or in which it will be necessary to displace it downward in order

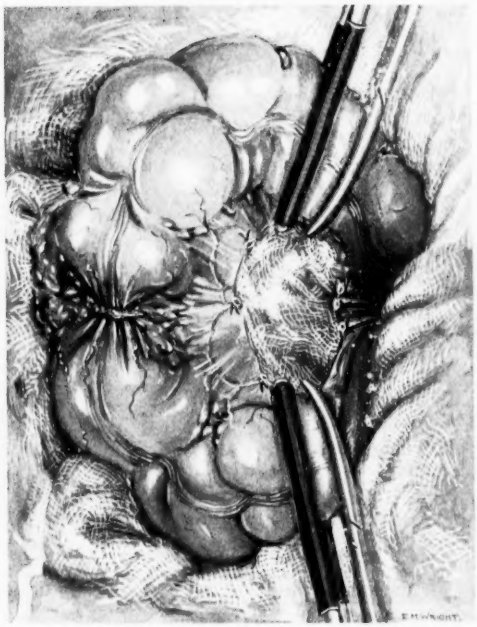

Fig. 3. Mesocolon divided and clamps applied. The colon is ready to be divided.

to make an anastomosis. The inner edge of the peritoneum is stripped inward toward the middle line, a little gentle pressure with a gauze swab being quite sufficient to effect the separation. This separation carries the colon with it until it is possible to pass underneath the colon up to the middle line. The ureter must be seen and preserved from injury, as it is very liable to remain adherent to the peritoneum and to be stripped up with it. Rough handling may injure the spermatic, ovarian, or other retroperitoneal veins and cause a certain amount of troublesome bleeding. When the left part of the transverse colon is removed, it is better to leave the omentum, and to do this it is necessary to free it. If the omentum is pulled upward and the transverse colon held downward as far as possible, the two will be put on the stretch and the peritoneum covering the colon can be freed from the omentum with a few touches of the knife. The separation can be continued with gauze stripping helped if necessary by the knife from time to time until the transverse colon and mesocolon are quite free.

When this has been done it will be found that the transverse colon, the descending colon, and the sigmoid flexure have been mobilized, the fetal condition has been reproduced and they are attached to a mesentery which is springing from the neighborhood of the left side of the vertebral column. Further when this mesentery is held up to the light the contained blood vessels are perfectly obvious even in those cases in which there is a good deal of extraperitoneal fatty tissue. These vessels are recognized and two ligatures are passed round the left colic artery by means of an aneurism needle, tied, and the vessel is divided between them. Should there be glands on the inferior mesenteric artery above the origin of the left colic they are to be dissected out and the fatty tissue which contains them stripped down until it lies below the point of ligature of that vessel. From this point incisions are carried through the peritoneum to the points at which it has been decided to divide the gut. As these incisions are being made, it will be necessary to divide and ligate the anastomotic branch of the middle colic artery above and the marginal artery below. The piece of colon which is to be removed is now lying with a triangular piece of mesentery attached to it. It is divided by means of a cautery between double clamps at each extremity and removed. The clamps which are applied to that part of the intestine which is to be left behind are crushing clamps with the grooves parallel to the length of the blade; those which are applied to the part which is to be removed are ordinary rubber covered gastro-enterostomy clamps which are closed as tightly as possible. The two ends of the colon are closed by a Pagenstecher thread stitch put in as follows: The clamp is held by an assistant and rotated first one way and then the other so that the two sides are alternately made accessible. Starting at the mesenteric border this stitch is carried over the clamp from side to side until the opposite end is reached. The stitches

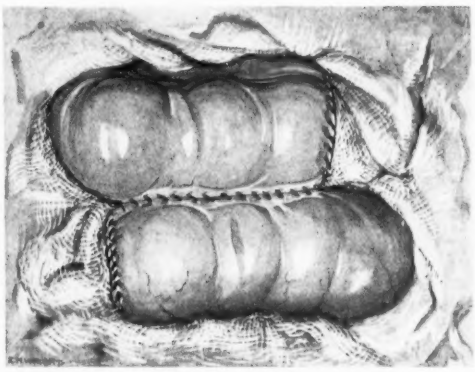

Fig. 4. Lateral anastomosis completed.

are placed parallel to the clamp and pick up the gut about ¼ inch from it. The stitch is held tightly at both ends, while an assistant frees and removes the clamp, when the thread is at once drawn tight. The stitch is then made to return to its starting point, the first line of sutures invaginated as it goes along, and the two ends tied together.

The two closed ends of the colon are then made to lie side by side, the sigmoid lying below the transverse colon. Rubber covered clamps are applied preparatory to a lateral anastomosis, in such a way that they will permit the opening to at least 2½ inches in length and situated along the muscular bands. Care is taken to see that the ends are not twisted and that the small intestine is well packed out of the way in the right side of the abdomen. Everything is protected by mackintosh swabs and the anastomosis may be proceeded with. The two pieces of colon are stitched together, along the length of what is going to be the anastomosis, by a thread stitch. Incisions are made into both of them, parallel, and at least 2½ inches long, as I have already stated. The mucosa is cleaned with swabs and as a final precaution a piece of gauze soaked in ether is pressed on to it for a minute or two. An inner stitch of chromicized catgut is inserted. It goes through all the coats of the gut wall, joins the adjacent sides of the two openings, then is made to pick up the two outer sides of the openings, and finally arrives at its starting point where it is tied off. The clamps are removed, and at this stage all the swabs are changed for clean ones and the surgeon and his assistant change their gloves. The outer thread stitch is completed by taking it along the anterior surface of the anastomosis back to its starting point where it is tied. The suture line may be reinforced, particularly at the two corners, by a few catgut sutures.

It has been found that discomfort after removal of the colon has been due to a blowing out of the two blind ends. To overcome this, the anastomosis should be done as close to the ends as possible, so that there shall be left as little "blind end" as possible. Further, this blind end may be buried in the wall of the colon. The blind end of the sigmoid lies in contact with the transverse colon proximal to the anastomosis. The two may be stitched together and the sigmoid buried in the wall of the transverse colon so that even the stitch used to close its end, is covered up. Care should be taken to see that the main lumen of the colon is neither pressed on nor kinked. The blind end of the transverse colon, which is lying in contact with the lower sigmoid, is dealt with in the same way.

The cut edges of the mesentery are approximated and joined together by interrupted catgut sutures, and it will be found that when the colon is returned to the abdomen all the raw surfaces have been covered up. Any deficient place in the peritoneal coat should be covered with omentum, and, further, the omentum should be wrapped round the suture line and fixed if necessary by a stitch or two, to prevent adhesions from forming.

The abdomen is closed in layers, a continuous catgut suture being used for the peritoneum and interrupted catgut sutures for the anterior layer of the rectus sheath. Five or six silkworm-gut sutures are inserted so as to include the skin, subcutaneous fat, and the anterior layer of the rectus sheath, and a small piece of fine rubber tubing is threaded over them before they are tied so as to prevent them from cutting into the skin. Finally the skin edges are approximated with Michel's clips. The wound is covered with a sterile dressing, glued to the skin to prevent it from slipping and the patient is returned to bed.

POSTOPERATIVE TREATMENT

The patient is propped up into Fowler's position as soon as he recovers from the anæsthetic and the general condition permits of it. Nothing is to be given by the rectum. If the condition is poor and fluids are urgently needed they must be given either subcutaneously or intravenously, otherwise he may start to take small drinks of water on the morning following the operation and they may be increased in amount as time goes on. No solid food is to be given until the seventh day when a little milk pudding can be taken.

No attempt should be made to force the bowels to open during the first 7 days; after that time liquid paraffin should be given night and morning and will produce the desired result. If there is a cæcostomy opening there will be no discomfort, but if not there may be a good deal of complaint of distention and flatulence. It is better not to take active measures to get rid of this, for the patient will pass flatus sooner or later.

The patient may be allowed out of bed about the fourteenth day and is usually ready to leave the hospital a week later.

Although not so common as after resections of the right side of the colon, diarrhœa is not infrequently a very distressing after effect. In the resistent cases it will react only to morphia but in the majority of cases it will subside if the patient takes bulky meals, drinks only between meals, and takes a bismuth mixture. It is to be expected to cause some upset for about 6 months, but after that time should disappear completely.

FROM THE CHIRURGISCHE UNIVERSITÆTSKLINIK OF HALLE

THE TECHNIQUE OF THE VOELCKER EXTRAPERITONEALIZATION OF THE URINARY BLADDER

WITH ILLUSTRATIVE CASES

HERBERT SUGAR, M.D., LOS ANGELES, CALIFORNIA
Assistant to the Chirurgische Universitætsklinik, Halle; Prof. Dr. Fr. Voelcker, Director

THE concealed position of the bladder in the pelvis, surrounded as it is by a bony ring and partly covered with other organs, creates a need for a special operation of approach in cases in which a wide exposure of the bladder is necessary. This is true particularly when the bladder is empty. For ordinary operations, such as the removal of stones and foreign bodies, for suprapubic prostatectomy, and even for resection of the anterior bladder wall the usual suprapubic extraperitoneal bladder exposure offers the simplest and best method of approach. One of the main difficulties that accompany this procedure, besides the obstacle offered by the bony symphysis, is the reflection of the peritoneum over the bladder. If the bladder is empty, an extraperitoneal approach is impossible. Fortunately, however, when the organ is filled with either fluid or air it is possible, due to the loose connection between the peritoneum and anterior bladder wall, to expose, in large part, the anterior wall of the bladder by bluntly pushing the peritoneum upward.

However, in those operations in which greater exposure and accessibility are necessary, as in the case of infiltrating tumors of the bladder vertex or in the lateral and posterior bladder walls with possible adhesions to neighboring organs, and when dealing with certain diverticula of the bladder, this simple extraperitoneal bladder exposure will not suffice. When resection of malignant tumors, or of diverticula lying in the posterolateral and posterior walls, or total extirpation of the bladder is considered, the maximum exposure is necessary. In attempting to obtain this desired exposure and mobilization of the bladder through the suprapubic incision, one encounters the peritoneum which, although fastened but very loosely to the anterior and posterior walls, is firmly attached to the bladder vertex over an area about the size of a silver dollar coin, which attachment prevents the complete freeing of the bladder. This problem is approached in different ways by the various methods in use.

The method much in vogue in America is the transperitoneal approach of Rydygier (2 and 12). With the patient in the steep Trendelenburg position, the peritoneal cavity is opened immediately by intention. A longitudinal incision then cuts through the bladder wall with the adherent peritoneum, thereby opening widely the posterior wall of the bladder. In this manner the posterior bladder wall is made movable and approachable. However, in spite of careful packing off and in spite of the well known resistive ability of the peritoneum, this method of opening the usually infected bladder transperitoneally nevertheless harbors a definite danger of peritonitis. Also the danger of implantation metastases in cases of neoplasm is to be considered. By means of other methods, however, these dangers can be avoided.

The method of Lichtenberg (9) seeks to free the peritoneal fold from its attachment to the bladder vertex by means of blunt dissection without opening the peritoneal sac, however. In cutting, the operator directs the scalpel more toward the bladder wall than toward the peritoneum. Only exceptionally, however, does one succeed in thus bluntly stripping off the peritoneal cap from the bladder. In the region of the vertex, the peritoneum is apt to be found so adherent that it will be torn in the attempt to separate it from the bladder. Moreover, it is probable that with this method small holes may be torn into the peritoneum without their being noted, thus harboring a hidden danger.

Based on the above deliberations, the Voelcker method of extraperitonealization of the bladder originated a procedure that combines the advantages of the extraperitoneal, with the excellent exposure offered by the transperitoneal, operation. The essence of the operation consists in the primary excision of the adherent section of peritoneal fold from the bladder vertex and in the careful and exact suturing of the peritoneal slit. The lateral and posterior walls of the bladder are then bluntly mobilized, this being easily accomplished, since in these areas the bladder is joined with the peritoneum by very loose cellular tissue. With this modification, the suprapubic bladder exposure makes possible any extensive resection of the bladder which may be necessary.

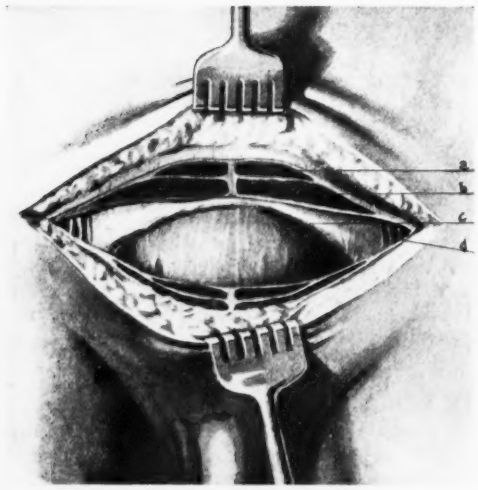

Fig. 1. The Bardenheuer transverse incision. *a*, Musculus pyramidalis; *b*, musculus abdominis; *c*, peritoneal fold; *d*, inferior epigastric vessels.[1]

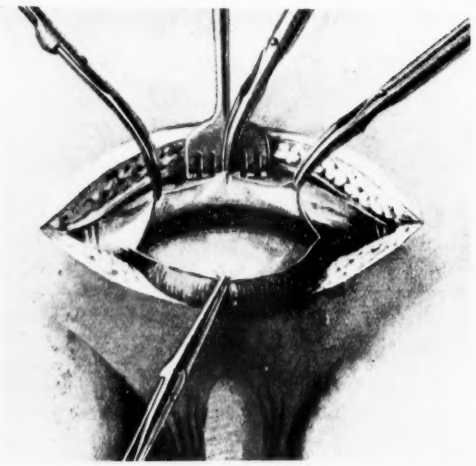

Fig. 2. Extraperitonealization of the bladder (Voelcker). First step: The peritoneum is opened at the bladder vertex and the adherent peritoneal cap is excised.

The procedure as described below seems not to have found its way into the American literature. The technique of this extraperitonealization of the bladder as practiced by Voelcker is as follows:

The preparation of the bladder is carried out as for the usual suprapubic operation. Lumbar or general anæsthesia as indicated is used. In order completely to utilize the advantages of this method in major bladder operations, such as resection, diverticulectomy, and total extirpation, the Bardenheuer transverse incision through skin and musculature is preferable to the vertical incision. The transverse incision can be carried more to the right or left of the middle line depending upon indication. The patient is always placed in the steep Trendelenburg position. After division of skin, muscle, and fascia transversalis in the transverse direction, one finds the peritoneal fold (Fig. 1) on the anterior bladder surface and attempts, first of all, to displace the peritoneum upward by blunt dissection. If these efforts have been successful the peritoneum is then transversely incised at its most posterior adherent point and the incision then carried laterally in both directions a distance equal to the extent of its transverse adherence to the bladder vertex (Fig. 2). The apex of the bladder is then drawn forward and displaced downward so as to emphasize the cleavage line between the posterior bladder wall and peritoneum. At this cleavage line the peritoneum is again incised at the point where it is no longer adherent to the bladder and this incision is sufficiently lengthened transversely in both directions so as to meet the lateral ends of the anterior peritoneal incision. The excised elliptiform flap remains hanging on the bladder and thereafter requires no further attention. The margins of the peritoneum are then grasped with clamps, the peritoneum is further separated by blunt dissection from the posterior wall of the bladder and the opening in the peritoneum is then exactly closed with continuous or interrupted sutures (Fig. 3). This extraperitonealization is in itself a relatively small operative procedure, and, especially with the proper Trendelenburg position, is easily carried out. During the further course of the operation the peritoneal sutures are protected by compresses.

It is striking how much the complete exposure of the bladder will be facilitated through this procedure, for, if the bladder is now pulled well forward, the entire posterior and lateral walls can be bluntly dissected free, and, like other organs, for example, the gall bladder, prepared as if hanging from a pedicle (Fig. 4). This method of suprapubic exposure with extraperitonealization makes every part of the bladder easily accessible for all major operative procedures, and vouchsafes also an excellent approach to the juxtavesical

[1] The illustrations in this article are from vol. i, by Voelcker and Boeminghaus, in *Handbuch der Urologie*. Berlin: Springer, 1926.

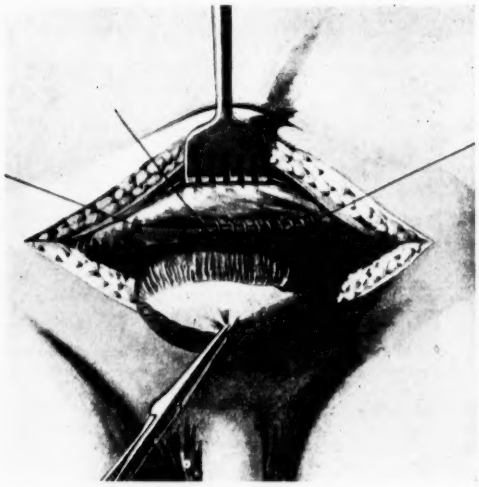

Fig. 3. Extraperitonealization of the bladder (Voelcker). Second step: The extraperitonealized bladder is drawn forward and the defect in the peritoneum is closed with continuous suture.

ureteral segments in case of ureterolithotomy for incarcerated stone in this region. The usefulness of this method of approach in this condition has been confirmed by the experience of Rubritius, Blum, and others.

The principal advantage of the Voelcker method lies in the fact that the superior accessibility gained is not purchased at the price of a greater risk as in the case of the transperitoneal approach; for the peritoneal cavity is closed off before the bladder is actually opened. The change in the normal anatomical relationship between the peritoneum and the bladder created by this procedure is only temporary, of which fact one can readily be convinced by observing such cases which may happen to go through another laparotomy for other conditions a short time thereafter in which it is found that the normal relationship has re-established itself.

To illustrate the usefulness of this method, some case reports of patients operated upon in this clinic during the past 2 years for bladder conditions are given below:

CASE 1. Diagnosis: malignant papilloma.

L. P., a man, aged 55 years, complained for the past 2 months of painful, frequent micturition and hæmaturia and showed at cystoscopic examination an ulcerating tumor of the left bladder wall.

Operation: a Bardenheuer transverse abdominal incision carried more to the left of the median line than to the right was made. The bladder was then extraperitonealized according to the method described above. Following mobilization of the bladder an infiltration of the left bladder wall was palpable whereas previous to the extraperitonealization it could not be felt. An opening in the left anterior bladder wall was then made and a large broad based, ulcerating, carcinomatous growth was found located in the left bladder wall. The ureteral orifices and other parts of the bladder were free. An oval section surrounding the growth was then excised through the entire thickness of the bladder wall. The bladder was closed in one layer and a drain was placed in the prevesical space. The abdomen was closed in layers.

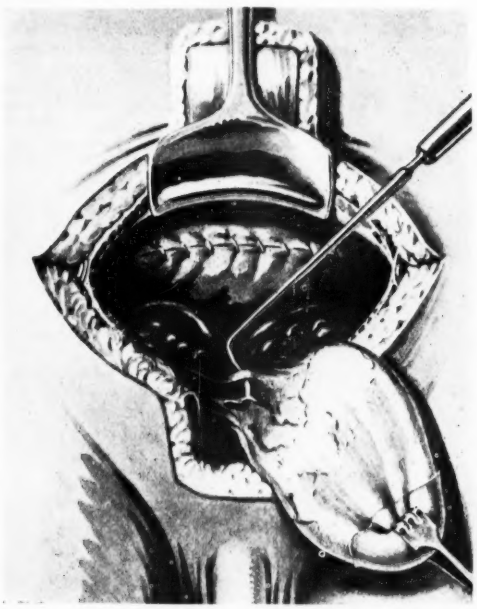

Fig. 4. Total extirpation of the bladder with temporary resection of the symphysis. Following excision of the adherent peritoneal cap at the bladder vertex, the posterior and lateral walls are then bluntly mobilized so that the bladder remains fixed only at its neck as if hanging from a pedicle.

Histological examination showed carcinomatous infiltration of the musculature. The form of the epithelium spoke strongly for malignant papilloma.

At the end of 17 days the patient was discharged from the hospital in good condition. The wound was well healed; the urine was clear and could be retained for about 3 hours.

CASE 2. Diagnosis: carcinoma of the bladder.

M. W., a man, aged 66 years, complained for the past 2 years of painful micturition and hæmaturia and showed at cystoscopic examination an ulcerating growth on the posterior bladder wall extending down to and involving the trigone. The ureteral orifices could not be definitely made out, inasmuch as they appeared to be overgrown by the tumor. The mucosa surrounding the tumor was very hyperæmic and œdematously thickened.

Operation: The bladder was exposed by the Bardenheuer transverse abdominal incision and, following extraperitonealization, a definite infiltration of the posterior bladder

wall could be felt. A small opening was made anteriorly and a tumor the size of a 50-cent piece was seen to occupy part of the posterior wall and almost the entire interspace of the trigone between the ureteral orifices. Probes passed up the ureters showed them to be free. The tumor had a crater form ulcerated center and had already infiltrated the bladder wall a depth of about 1 centimeter. It was evident that to carry out a radical resection would surely lead to difficulties with the ureters. With the patient's general condition below par, his advanced age, the possibility that a radical resection might necessitate a bilateral re-implantation of the ureters, it was therefore decided to renounce the radical procedure. With a sharp curette, the ulcer was thoroughly scraped out and the base cauterized. An indwelling catheter was inserted through the urethra. The bladder was closed with one layer of catgut. A drain was placed in the space of Retzius and the abdomen was closed in layers. Histologically the tumor was a squamous cell carcinoma.

At the end of 25 days the patient was discharged from the hospital in good condition; the wound was well healed, and the urine was clear.

CASE 3. Diagnosis: diverticulum of the bladder, sclerosis of internal sphincter.

K. H., a man, aged 66 years, complained for the past 3 years of frequent painful micturition, turbid urine, and occasional terminal hæmaturia. For the past 6 months he had had urinary retention requiring catheterization two and three times daily. At the age of 20 he had had a neisserian infection that had induced a stricture of the posterior urethra and bladder neck for which he had had dilatation. Cystoscopy showed a diverticulum opening into the posterior bladder wall just above the trigone, which finding was confirmed by cystography.

Operation: a Bardenheuer transverse abdominal incision was used. The bladder was then extraperitonealized according to the method of Voelcker. Through a small incision in the vertex the opening of the diverticulum was found in the posterior wall just above the trigone. Due to the complete mobilization of the bladder achieved through the extraperitonealization, excellent approach was had to the posterior wall of the bladder. The neck of the diverticulum was resected and the resultant opening in the bladder was closed with a single layer of catgut. However, the sac proper was located rather deeply between the rectum and the bladder and was so firmly adherent that it could be removed from the rectum only by means of sharp dissection, which was successfully accomplished without injury to the latter. Following the diverticulectomy, examination of the bladder sphincter showed it to be sclerotic and inelastic. This obstruction in all probability explained the etiology of the diverticulum. The sphincter was so incised as comfortably to allow a finger to be inserted in the posterior urethra. The bladder was drained from above through a large tube sewed into the opening in the vertex which had been made at the beginning of the operation and the bladder edges were then sewed watertight around it. The diverticulum bed was also drained. An indwelling catheter was passed to the bladder through the urethra. The abdomen was closed in layers.

At the end of 28 days the patient was discharged in good condition. The wound was well healed; the urine was clear and he could urinate spontaneously without pain.

CASE 4. Diagnosis: carcinoma of the bladder.

M. H., a woman, aged 55 years, complained for the past 2 months of painful micturition and constant gross hæmaturia. Cystoscopic examination revealed an ulcerating tumor in the posterior wall extending almost to the ureteral orifices which, although thickened with œdema, appeared to be uninvolved.

Operation: Bardenheuer transverse abdominal incision was used. Extraperitonealization of the bladder according to Voelcker was then attempted. However, after the anterior peritoneal incision had been made, it was discovered that the greater part of the posterior wall of the bladder was invaded by a tumor which had also invaded the peritoneal covering over a large area. By means of careful palpation it was found that even below this peritoneal fold the tumor was adherent to the uterus. Apart from its adherence to the uterus, the tumor was still movable and no metastases appeared to be present, so that its resection was still possible. Before proceeding with this, however, the completion of the extraperitonealization of the bladder was undertaken. Because of the complicating infiltration into the peritoneal fold covering the vertex and posterior bladder wall, this had to be accomplished in a somewhat modified manner. A transverse incision was, therefore, made in the peritoneum covering the anterior wall of the uterus just proximal to the point where it reduplicates and the peritoneal flap so won was reflected upward and sewed with the anterior peritoneal margin, thus closing off the peritoneal cavity. By means of scalpel the tumor was then sharply separated from the uterus and the bleeding uterine musculature was brought together with a row of catgut sutures. The tumor was then completely removed by excision of the involved section of the posterior bladder wall. The bladder was first sutured posteriorly lengthwise, but after four or five sutures the tension became excessive. Therefore, the left half of the bladder of which there had remained more than the right was pulled over and sewed on with transverse continuous sutures so as to form the roof. In this manner the bladder was completely closed. A drain was placed in the space of Retzius and an indwelling catheter was inserted through the urethra.

Examination of the specimen showed that the tumor was about 7 by 7 centimeters wide and about 2 centimeters thick, with its mucosal surface extensively ulcerated. Histologically it was a squamous cell carcinoma.

At the end of 25 days the patient was discharged in good condition. The wound was well healed. The urine was clear and could be retained about 4 hours without difficulty.

CASE 5. Diagnosis: carcinoma of the bladder.

M. A., a man, aged 68 years, complained for 14 days of frequency and hæmaturia. Cystoscopic examination revealed an ulcerating growth on the right bladder wall. Cystography showed a defect of the right bladder wall.

Operation: a Bardenheuer transverse abdominal incision was carried more to the right than to the left. The bladder was then extraperitonealized according to the method of Voelcker. Following this mobilization of the bladder an extensive infiltration of the right wall could be definitely palpated, whereas previous to the extraperitonealization this could not be clearly felt. An opening in the right anterior bladder wall was then made and a bleeding, broad based carcinoma-like tumor about the size and form of a hen's egg was found located in the right posterior wall which was deeply infiltrated. The tumor extended just above the right ureteral orifice. The tumor, with a liberal portion of the surrounding bladder wall, was resected in the form of an oval flap. The bladder was closed with a single layer of catgut. An indwelling catheter was passed to the bladder through the urethra. A drain was placed in the space of Retzius. The abdomen was closed in layers.

Examination of the specimen showed an extensive ulceration of its mucous surface. Histologically it was a squamous cell carcinoma.

At the end of 18 days the patient was discharged from the hospital in good condition and with no complaints. The urine was clear and could be retained about 4 hours without difficulty.

The purpose of this paper is not to report a large number of cases or to discuss the detailed treatment of neoplasms of the bladder; rather the technique of a method and a few cases illustrating its application are given in an attempt to show the usefulness of the Voelcker extraperitonealization of the urinary bladder as a preliminary step to such major operative procedures on the bladder as resection, diverticulectomy, and total extirpation. The value of this method can best be judged if one considers the excellent approach that was obtained to the different parts of the bladder which were involved in these cases and the comparative ease with which these usually difficult operative procedures could thereby be accomplished. In Case 1, the tumor was in the left lateral wall; in Case 2, the tumor was in the bladder fundus; in Case 3, the diverticulum was in the posterior wall just above the trigone; in Case 4, the tumor was in the posterior wall and had invaded the uterus and the peritoneum covering the posterior wall of the bladder; in Case 5, the tumor was located on the right posterior wall.

Inasmuch as most bladder tumors have their origin in the region of the bladder floor, a complete mobilization and exposure of the posterior bladder surface is of utmost importance, because of the possibility thereby offered to operate more radically and more easily. In the case of broad based and infiltrating tumors, a section of the entire bladder wall should be removed. The end-results of operations for cancer of the bladder have confirmed such radical procedure in the experience of most surgeons (1, 4, 5, 7, 10, 13).

It is obvious, of course, that this method when compared to the usual transperitoneal method, also offers a better and safer means of judging the operability of tumors or the presence of metastatic infiltrative processes into the neighboring organs before the actual surgical procedure on the bladder is begun. The operation can thus be timely discontinued, thereby avoiding both a useless operation and also the opening of the bladder with the risk of contaminating the peritoneal cavity.

It should also be pointed out that here, as in the transperitoneal method, the peritoneal opening can be utilized in the seeking for abdominal metastases. Judd cites two cases in which extensive metastases were found in the liver and in the pelvic peritoneum thus making the contemplated radical operation unnecessary (6).

The decision as to whether just a simple suprapubic cystotomy or extraperitonealization is indicated depends mainly on the cystoscopic findings. With the exclusion of cases that are amenable to endovesical treatment, the ordinary extraperitoneal suprapubic exposure should suffice for the ordinary cases, such as stone, foreign bodies, tumors of the anterior bladder wall, and pedunculated growths in the other walls of the bladder. In all other cases in which the operation takes the form of a resection and has to extend over into the superior, posterior, and lateral walls of the bladder, or in cases in which the extent of the pathological process cannot be cystoscopically, definitely defined previous to operation, then the method of choice is the suprapubic exposure plus extraperitonealization of the bladder, inasmuch as this method allows a critical survey of the entire field before the actual procedure on the bladder. Moreover, it fulfills the requirements necessary to operate on any part of the bladder without complicating the operative procedure.

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ALCOHOL INJECTIONS FOR POSTOPERATIVE PAIN IN THORACIC SURGERY[1]

GASTON LABAT, M.D., New York

ALLEVIATION of painful conditions by blocking the nerves with alcohol has been practised for a number of years. Affections of the trigeminal nerve and its divisions, particularly the second and third, have thus been treated with remarkable success. Attacks of angina pectoris have also been greatly benefited by alcoholization of the upper thoracic nerves at their exits from the intervertebral foramina. Injections of alcohol and neocaine in varying proportions have improved the condition of many patients suffering from sciatica. A recent development in thoracic surgery is the blocking of the thoracic nerves to alleviate postoperative intercostal neuralgia.

The literature is silent on the use of alcohol injected after operation for the relief of intercostal neuralgia in thoracic surgery.

Among the diseases of the chest requiring surgical intervention is pulmonary tuberculosis in the stages of abscess cavities, hæmorrhage, or empyema. For such cases, the consensus of opinion is that pulmonary compression offers the best prospect of improvement and, in a great percentage of them, the only hope of a cure.

All forms of surgical treatment tend toward the achievement of procedures by which the diseased lung can be collapsed and compressed in whole or in part and the empyema obliterated. The methods by which a complete pulmonary collapse may be achieved are artificial pneumothorax and extrapleural thoracoplasty. A partial collapse is obtained by phrenico-exeresis and by pneumolysis. It is in the relief of pain occurring after extrapleural thoracoplasty that we are particularly concerned in this paper.

Extrapleural thoracoplasty is a major operation which, when indicated, is done in two, three, or more stages. It involves the resection of the first to the tenth or eleventh rib, secondary removal of longer segments or ribs previously resected, and total costatectomy. In most of these cases the pleura is thickened and structural changes are present in the ribs incident to cicatricial contraction. This is particularly true in cases of effusion of long standing. Repeated operations upon the same ribs with the object of removing longer segments have a tendency to increase the grade of thickening and the extent of cicatricial repair. Although subperiosteal resections are usually performed, the intercostal nerves may be traumatized or included in scar tissue formation and thus result in painful conditions.

The process, however, may be altogether different and one of the nerves may be exposed to irritation by a drainage tube, perhaps as a result of progressive erosion or sloughing off of the parts in which the nerve used to be embedded. Maintenance of the tube as a necessity may be so painful as to render it intolerable.

Postoperative pain and intercostal neuralgia are well known sequelæ of thoracoplasty, as evidenced by the constant attempts to mimimize their occurrence and severity. The avoidance of trauma to the intercostal nerves, vessels, and muscles eliminates postoperative pain and lessens the chances of later intercostal neuralgia. Alexander believes that the use of such instruments as the Doyen raspatory is of great advantage in eliminating such trauma.

All methods hitherto employed to lessen postoperative pain involve the temporary impairment or permanent destruction of the nerves in the course of thoracoplasty. Wilms crushed the intercostal nerves. Davies and Hedblom inject a few drops of 80 per cent alcohol around or into each nerve as far posteriorly as possible. Jessen, Stocklin, and Muhsam resect from 1 to 2 centimeters of each nerve, sometimes together with a section of the overlying periosteum. Sauerbruch resects similar lengths in patients with thickened and œdematous periosteum, his experience being that otherwise they are apt to suffer from intercostal neuralgia. On the other hand, Brauer has never met with postoperative intercostal neuralgia.

The permanent destruction of nerves in the course of the operation is less commendable than their temporary impairment by the injection of 80 per cent alcohol, as practised by Davies and Hedblom. Extensive alcoholization may, however, result in paralysis of important muscles, the function of which it is wise to preserve. Although paralysis of the abdominal wall has not been reported as harmful, resections and alcohol injections of the lower intercostal nerves should be avoided. Hug has found that patients in whom the lower intercostal nerves have been paralyzed show a bulging of the abdominal

[1]Read before the American Society of Regional Anesthesia, New York, April 2, 1929.

muscles of the same side, especially of the epigastrium and costal border. Some of them need the continuous support of an abdominal bandage.

Paralysis of one-half of the most important muscles used in expectorating cannot, in the opinion of Alexander, be considered harmless in view of the relatively high incidence of stasis pneumonia following thoracoplasty. Furthermore, the bulging of the costal margin, as a result of paralyzing the lower intercostal nerves, partially defeats the aim of rib resections by decreasing to a certain extent the amount of lung compression. It would seem plausible, therefore, to discontinue the practice of destroying the intercostal nerves deliberately in the course of thoracoplasty and to inject alcohol only in those cases of neuralgia diagnosed after operation.

Alcohol injections should be made only after scrupulous analysis of anatomical conditions and correct diagnosis of the nerves involved. Resection of the ribs flush with, or at short distances from, the transverse processes destroys their main support, tends to change the position of the ribs, and disturbs landmarks. Removal of large segments of the first ribs causes morphological displacements of all the structures of the hemichest. Repeated operations involving the lower ribs exaggerate the anatomical distortions already present. The picture is so changed that laterally the ribs appear almost vertical, when viewed from the front (Figs. 1 and 2).

These distortions of the bony framework are reflected on the nerves also, and it needs careful exploration to define the nerves along which stimulations of deeply seated structures are carried to peripheral areas of the skin.

A remarkable method of diagnosing the nerves supplying the region to which the pain is referred consists in examining the X-ray pictures and comparing them with the patient. Measurements are taken from the painful area to well defined bony landmarks on the same side and are superimposed on the X-ray pictures (Fig. 2).

Corrections are made for differences in size between the patient and the picture, and the intercostal spaces recorded in front. By counting the spinous processes downward, it is possible to arrive at a fairly accurate diagnosis (Fig. 3).

Injection of the nerves in the intercostal space is of little value, if any, because landmarks are missing as a result of rib resection. The only practical method is that of paravertebral block by which the nerves are injected close to the spinal column. It may be necessary to inject one nerve above and one nerve below those already injected.

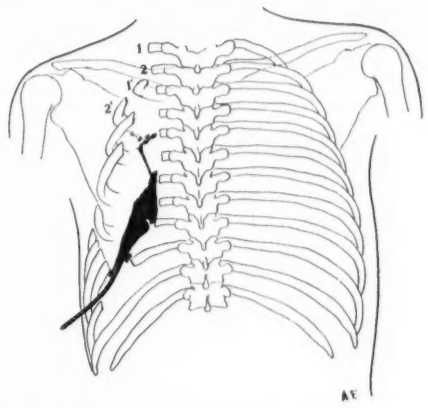

Fig. 1. Outline of the bony framework drawn from a roentgenogram, showing the degree of collapse of the lateral wall and the extent of the downward displacement of the first two ribs 1–1′, 2–2′, in particular.

This should be done only after making sure, by testing the field, that the area of anæsthesia first obtained is not wide enough to give complete relief. Stress must be laid on the wisdom of restricting the block to the desired region, because alcoholization is followed by very long periods of numbness which may cause discomfort if the numbness covers an extensive area.

The use of 95 per cent alcohol in the treatment of trigeminal neuralgia gives better results than when 80 per cent alcohol is injected, probably because the nerves are blocked by the extraneural method. Similarly in paravertebral block, the higher the percentage of alcohol the deeper the anæsthesia and the longer the period of relief. Injection of 3 cubic centimeters at each nerve is quite sufficient.

The landmarks are, as usual, the spinous processes of the dorsal vertebræ. If the nerves to be injected are among the upper six, it is best to define the prominent seventh cervical spine and count the dorsal spines from above downward. If the injections are to be made lower than the sixth nerve, it is preferable to count the spinous processes by starting from the twelfth dorsal spine which is defined as follows:

The middle line of the back and the direction of the twelfth rib on the uncollapsed side are traced on the skin by means of small applicator moistened with tincture of iodine. These lines generally meet at the tenth dorsal spine and include an acute angle. Of all the perpendiculars dropped from the twelfth rib onto the middle line of the back, that which measures 5 centimeters

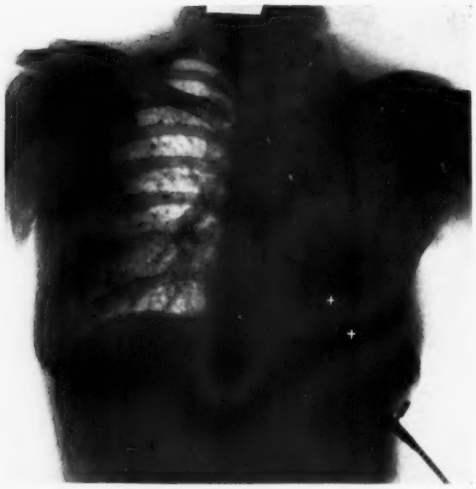

Fig. 2. Roentgenogram with the painful areas plotted according to mensuration taken on the patient. The crosses mark the region of skin radiations of pain induced by introducing the tube.

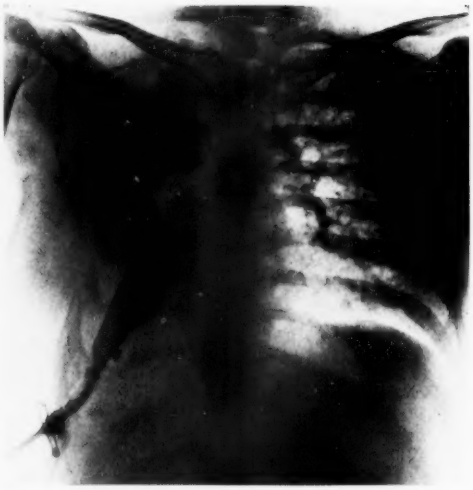

Fig. 3. Roentgenogram of the back showing the stumps of the ribs and the extent of the resections. Note the morphological displacements of the hemichest.

marks the level of the twelfth dorsal spine (Fig. 4).

Wheals are raised with 0.5 per cent neocaine solution opposite the selected spinous processes at a distance of 4 centimeters. If the scar marking the line of incision is in the way, the wheals should be made lateral to it, as it is preferable to approach the deep structures in an oblique direction (Fig. 5). The Labat needle (80/8) is passed through the wheal in a direction normal to the surface of the skin and introduced toward the stump of the resected rib with which it comes in contact at a depth of from 2 to 3 centimeters. The needle is then partially withdrawn and reintroduced downward, inward, and forward, 45 degrees in all directions, until the point of the needle is 2.5 centimeters deeper than the point at which contact was made. The injection is then made without displacing the needle.

Pain may be experienced while maneuvering the needle through the slice of scar tissue formed in the plane of the surgical incision. It is not advisable to inject neocaine before the alcohol, because such a procedure blunts sensibility, may prevent the induction of paræsthesias along the selected nerves and thus defeat the aims of the injection technique. The relief is instantaneous and complete when the injection is made following paræsthesias in the territory of the original pain.

The technique is fraught with difficulty when the ribs have been resected flush with the transverse processes. In this case, the needle loses its best guide, which is the rib, and must rely on the transverse process which is more superficially situated. Care must be exercised not to slant the needle too much for fear of making the injection over the laminæ or passing between them, thus, in the first case, serving no purpose and, in the second, making an intraspinal injection. The needle should, in its first thrust through the wheal, be slightly inclined inward so as to make contact with the transverse process.

Mrs. G. E. W. was referred to Dr. Lilienthal in September, 1928. She had been ill for a number of years, certainly since February, 1923. Then a diagnosis was made of tuberculosis of the entire left lung. Artificial pneumothorax in July, 1923, was about 90 per cent successful, owing to adhesions in the upper chest with cavity formation. This collapse became reduced to only about 50 per cent. Several times, fluid had appeared in the pleura which absorbed and reappeared. The pleura became extremely thick. A sample withdrawn by needle was opaque but contained no tuberculosis bacilli. Cough and expectoration had been constant from the beginning, but had diminished until May, 1928; the case seemed to have been arrested and the patient married. Within a month, there was sudden fever and it became necessary to drain the left chest, which was done by thoracotomy with resection of the eighth rib. Meanwhile, the right lung, although it showed evidence of diffuse injection, had remained stationary and the process here appeared to be arrested. After temporary relief, the fever again rose to 104 degrees F. and she came to New York where Dr. Lilienthal first saw her about December 15, 1928. On examination it was observed that the drainage of thick pus was insufficient and this was corrected by changing the tube.

Her general condition was good and fever had been moderate for some days. There were evidences, however, of pleuropulmonary fistula. It was decided, after an X-ray examination with lipiodol instilled through the fistula, that a large empyema cavity existed and there was, in any event, a discharging cavity in the upper lobe of the left lung. It was evident that nothing short of a complete surgical collapse of the chest wall on the left side would promise to obliterate both the pulmonary and the pleural cavities. This was carried out in two stages, both operations being performed with the aid of general anæsthesia by nitrous oxide and oxygen, administered by Dr. William Branower. The first stage was on December 20, when *sections of the first to the fifth rib were removed, about 16 inches in all.* At the same time, a second drainage opening was made by removing *about an inch of the tenth rib together with its periosteum in the posterior axillary line* (see Fig. 6). The operation was well borne, the blood pressure 2 days later being 116–70. The healing was prompt and by January 10, 1929, there was very little cough and the temperature was normal. On January 14, the patient was again operated on. A free incision was made in the seventh interspace and *long sections of the sixth, seventh, and eighth ribs were removed.* The fifth rib was also shortened by further section of the divided ends. So much of the bony chest wall was thus removed that when compression was made from without, the walls of the empyema cavity almost touched. A large tube with a finger cut valve was placed through the lower drainage opening and it functioned well after the edges of the upper drainage opening had been drawn together with plaster. Following this second procedure, there was for about a week a stormy time, principally, however, on account of the apprehensiveness of the patient. Another test was made on January 30, by the injection of an aniline dye through the pleura. The color appeared with the sputum in a few hours. "The cough was the least of our troubles," says Dr. Lilienthal. The actual quantity of mucopurulent expectoration amounted to about 5 to 8 cubic centimeters a day. As a therapeutic measure, a transfusion of 400 cubic centimeters by the direct method was performed by Dr. Nathan Rosenthal. Following a rather sharp reaction, there was rapid improvement and by the first of March, Dr. Lilienthal would have sent this patient back to her home except that there was one difficulty. Any slight motion of the chest, while the tube was in place, produced pain in what was supposed to be the distribution of the eighth or perhaps the seventh intercostal nerve. The pain was very severe whenever the tube was withdrawn or inserted because of the internal fistula. It was absolutely necessary for the patient to wear a tube for drainage until the fistula closed, which it was hoped would occur. Because of the extreme anatomical deformity of the bony chest wall, it was almost impossible to judge exactly which nerves were being irritated by the tube. Dr. Lilienthal made one attempt to inject alcohol into the intercostal structures behind what appeared to be the painful region but without success. It was at that stage that I was called upon for counsel. We saw the patient on Monday, March 4, 1929, and after carefully examining the chest and inspecting the X-ray pictures, I suggested that it would be advisable to attack the appropriate nerve roots with the hope of permanently blocking the entire region about the drainage fistula. The fourth, fifth, and sixth thoracic nerves were injected with 95 per cent alcohol. This was done on March 5 in the patient's room in the presence of Dr. Lilienthal. Immediately after the injections, Dr. Lilienthal tested the result of the injections. He inserted the tube without the knowledge of the patient. He removed it and replaced it several times with no expression of pain on her part. Relief was complete and Mrs. W. went home a few days later in perfect comfort, so far as her surgical wound was concerned. On March 15, I received word that the patient was entirely free of pain. The prognosis of this case seems excellent, even though it may be necessary for a tube or plug to be worn for a considerable time.

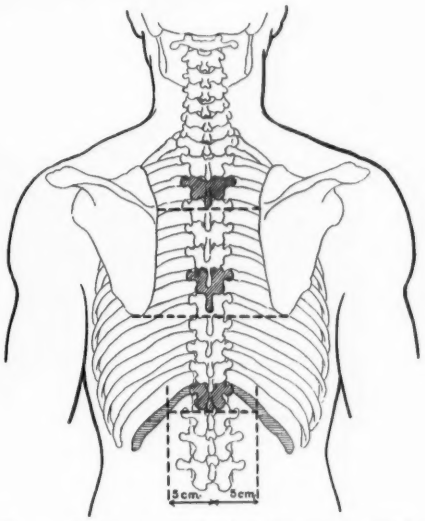

Fig. 4. Landmarks of the dorsal vertebræ. With the arms alongside the body, the horizontal line passing through the spine of the scapulæ marks the spinous process of the third dorsal vertebra; that drawn at the level of their inferior angle passes between the seventh and eighth dorsal spines. The perpendicular, measuring 5 centimeters, dropped from the twelfth rib on the midline of the back, marks the spinous process of the twelfth dorsal vertebra. (From *Regional Anesthesia*, Saunders.)

It is expected that anæsthesia will last for months and perhaps until nature shall have provided adequate protection against irritation by the tube. Even if our expectations fail to realize themselves, there is still left the expediency of reinjecting the nerves with alcohol.

The incidence of postoperative pain or intercostal neuralgia associated with thoracoplasty must be extraordinarily great, since particular care is taken by most surgeons to impair the nerves or destroy them at the time of the operation. It has been shown that the effects of such wide destruction are not altogether harmless when the lower intercostal nerves are concerned. Furthermore, it has been observed that not all the nerves are influenced by unintentional surgical trauma, or involved in cicatricial repair, or become exposed to irritation as a result of destructive pathological processes. It would, therefore, seem advisable to leave the nerves intact in the

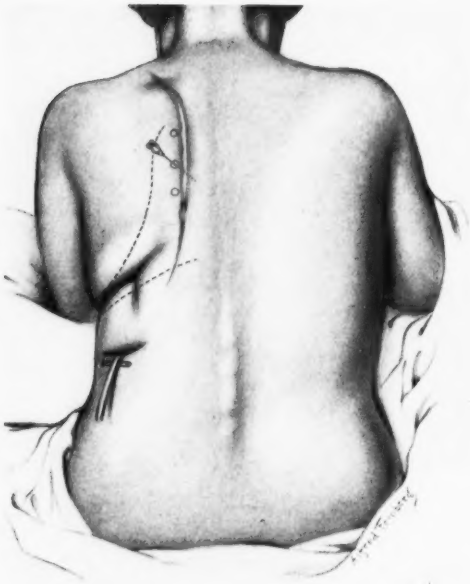

Fig. 5. Drawing from nature showing the sites of injection and the area of numbness following alcohol injections of the fourth, fifth, and sixth dorsals.

Fig. 6. Photograph showing characteristic scar of upper thoracoplasty and the more unusual intercostal incision for the lower half of the operation. The tube is air tight. It is fitted with a rubber valve which is protected by a bag of gauze into which the small quantity of drainage flows.

course of the operation, and institute treatment in the occurrence of postoperative neuralgia. In this manner, it would be possible to save many nerves, particularly the lower intercostal nerves, which supply muscles the function of which is considered most valuable in the act of expectoration.

Injection of the brachial plexus can be made with weak concentrations of alcohol without marked impairment of the motility of the upper extremity. After careful analysis of the affected branch, one root of the plexus can be injected by the paravertebral method. If the entire plexus should be involved, there is no objection to injecting it with alcohol and neocaine in certain proportions, since these drugs have a greater affinity for sensory than for motor nerves. If motor function should be reduced as a result of the loss of conductivity, special training of the central nervous system would in time restore efficiency.

There are many other types of postoperative neuralgia which would be greatly benefited if treated by alcoholization of the affected nerves. Perhaps greater is the number of patients suffering from incurable diseases who are given morphine daily for the alleviation of their sufferings. Alcohol injections would be welcomed by those patients.

The author wishes to extend to Dr. Lilienthal his sincere thanks for this history and the expression of appreciation for the great privilege of reporting this case. To the patient, Mrs. G. E. W., we are particularly grateful for her kind permission and valuable co-operation.

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MICROMELIA IN A CHILD IRRADIATED IN UTERO

DOUGLAS P. MURPHY, M.D., F.A.C.S., AND LEOPOLD GOLDSTEIN, M.D., PHILADELPHIA
Cynecean Hospital Institute of Gynecologic Research, University of Pennsylvania

ACCORDING to recent studies by the authors (3, 4, 5, 6, 8, 9), therapeutic maternal pelvic radium or roentgen irradiation during pregnancy is extremely likely to injure the fetus. Microcephaly is the defect most commonly produced, e.g., of 76 children irradiated *in utero*, 19 (25 per cent) were reported as being microcephalic idiots.

Other developmental disturbances were also observed among the irradiated children. Three of them exhibited congenital malformations of the extremities, brief descriptions of which are presented in Table I.

Another case of deformity of the extremities in a child irradiated *in utero* is reported in this paper. This gives us a total of 77 irradiated children, 4 of which (5 per cent) manifest malformation of the limbs. The following case is reported because of the possible importance of the irradiation as a cause of the arrested development.

CASE REPORT

Mrs. X., who had previously given birth to 2 healthy children, developed metrorrhagia at the age of 40 years. This condition was attributed to a menopausal disturbance, and roentgen therapy was accordingly advised.

Without a preliminary curettage, a series of therapeutic roentgen exposures was begun. The last normal menses occurred on February 22, 1926, at about which time conception probably took place. The first roentgen treatment was given on April 16, during the second month of gestation. Fetal movements were felt for the first time on July 9. Three days later, the last roentgen treatment was administered. Details of the course of treatment are given in Table II.

On December 4, 1926, or 5 days before term, a stillborn female child was delivered without difficulty.

Description of child. The deformed fetus was preserved as a pathological specimen. On May 1, 1929, it was examined, but since autopsy was denied only superficial examination and roentgenographic studies were possible.

As will be observed from a study of the accompanying photograph (Fig. 1) the head and trunk appeared to be well proportioned and not grossly deformed. The extreme shortness and deformity of the lower extremities, and the less marked shortness of the upper extremities, however, give the impression that the trunk is abnormally long.

The roentgenogram (Fig. 2) discloses the absence of 2 long bones in each of the lower extremities. Dr. Henry K. Pancoast who examined the film, stated as his opinion that the one long bone present in each extremity was in all probability the tibia.

TABLE I. CHILDREN, IRRADIATED *IN UTERO*, SHOWING DEFORMITIES OF THE EXTREMITIES

Author	*Description of the deformities*
1. Bailey, H., and Bagg, H. J.	Spina bifida and club-feet.
2. Feldweg, P.	Deformities of both forearms; absence of both radii; arms dislocated externally at elbow joints.
3. Ries, E.	Hydrocephalus; absence of right forearm; absence of 2 fingers on right hand; abdominal malformations.

This case of micromelia (congenital shortening of the extremities) with absence of several of the long bones in the lower extremities, suggests irradiation as the cause of the arrested development. The correctness of this assumption cannot, however, be definitely determined as deformities of this type sometimes, although very rarely, occur in non-irradiated children. Since radiation may arrest the development of the central nervous system, the possibility that it may also arrest the development of other organs must, however, be seriously considered.

In a survey of 81,000 births, made by Mall (7), there were 115 children with deformed extremities, which is equal to a deformity rate of 0.14 per cent. This rate is one thirty-fifth of that (5 per cent) found in the group of children irradiated *in utero*. The high deformity rate in the latter group, as compared with the rate in the case of the non-irradiated children, strongly suggests the irradiation as the etiological factor.

If fetal irradiation will arrest development, how may such an accident be prevented? The answer lies in the careful adherence to one procedure, namely, preliminary curettage. This operation performed before the employment of pelvic radium or roentgen irradiation, would destroy any unsuspected embryo and consequently prevent the birth of a damaged child. It would also disclose the exact pathological condition of the uterine mucosa, and would reveal the existence of

TABLE II. DETAILS OF ROENTGEN TREATMENT

No. of treatments	Date	Time of exposure, minutes	Milliamperage	Penetration (k. v.)	Filter, mm.	Focal skin distance, in.	Areas
1	4-16-26	30	4	200	¼ Cu.	15	2 ant.
2	4-20-26	9	4	85	4 Al.	10	6 post.
3	5- 7-26	10	4	85	4 Al.	10	6 ant.
4	5-11-26	10	4	85	4 Al.	10	6 post.
5	6- 4-26	8	4	100	¼ Cu. 1 Al.	15	6 ant.
6	6- 8-26	8	4	100	¼ Cu. 1 Al.	15	6 post.
7	7- 9-26	8	4	100	¼ Cu. 1 Al.	15	6 ant.
8	7-12-26	8	4	100	¼ Cu. 1 Al.	15	6 post.

Coolidge tube, Wappler machine.

Fig. 1. Photograph of stillborn female white child, which was exposed to therapeutic roentgen irradiation, from the second to the fifth months of fetal life while the mother was being treated for menopausal hæmorrhage. Note the shortness and deformity of the lower extremities.

Fig. 2. Roentgenogram of child shown in Figure 1. Note the presence of only one long bone in each lower extremity.

fundal carcinoma, so often overlooked in the radiological treatment of pelvic disease characterized by hæmorrhage (10).

It might also be stated here that instances are known to the authors (5), in which conception has taken place in the interval between two of a series of roentgen exposures, without the knowledge of the radiologist. Therefore, when a series of roentgen exposures is being undertaken, the patient should be warned of the danger of becoming pregnant during the course of treatment.

CONCLUSION

On the basis of this study we believe that therapeutic pelvic roentgen irradiation during pregnancy may arrest the development of the bones as well as that of the central nervous system.

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LIPOSARCOMA OF THE MAMMARY GLAND

RICHARD A. LIFVENDAHL, M.D., CHICAGO
From the Department of Pathology, Cook County Hospital

TUMORS composed of tissue resembling embryonic connective and fat tissue do not occur frequently. Since Robertson's review of the subject, in 1916, a moderate number of similar benign and malignant growths which have been located in various organs and structures of the body have been reported. It is to be noted that by far the most frequent sites of predilection are the lower extremities (Jacobson, Ewing, Jaffé, Schiller) and the retroperitoneal space (Wells and Hirsch, Salzer); that is, in those parts of the body where the amount of fat is greatest. The mesentery (Terrier, Waldeyer, Madelung), kidney (McConnell, Harbitz), muscles of the forearm (Stich), face (Senftleben), pleural cavity (Barbier and Mollard), lumbar dura mater (Caldwell and Zinninger), uterus (Springer), suprarenals (Schwarz), midline of the back (Razor), shoulder (Comells), mouth and nose (Stanze), and the face with involvement of the neck have all been recorded as the occasional situation of this type of neoplasm.

These tumors are regarded as being of moderate malignancy because there is, usually, a well defined capsule, growth is slow, and they are freely movable in the surrounding tissues. However, there is a marked tendency to recurrences and, occasionally, metastases occur to the lungs, mediastinum, subcutis, and the joints (Ewing). Also a marked xanthomatous quality is not often associated with a malignant course. Severe complications, at times, may result such as pressure upon adjacent vessels and nerves with subsequent alteration of the organs supplied. In addition dilated and tortuous veins frequently course over the mass, and this factor, in the presence of infection, ulceration, abscess, or gangrene predisposes to sepsis particularly when surgical procedures are performed.

Other neoplasms may closely simulate a liposarcoma, and therefore certain restrictions must be made in making this diagnosis. In fact, the existence of the group of new-growths under discussion was much doubted by Ribbert and Schwalbe. Sarcoma arising from the connective tissue of a lipoma is well illustrated in the case of Schiller in that a tumor of fat had been present in the breast of a woman for 6 years and after this period a sarcoma developed in the scar tissue which had formed after the removal of the benign mass. Jaffé calls attention to the observation that new-growths which are associated with cartilage, bone, or myxomatous tissue give rise to atypical structures which may resemble the histological picture of liposarcomata. Mixed tumors, too, may contain considerable amounts of fat, but here the fat plays only a passive rôle. Immature fat cells are frequently abundant in rapidly growing lipomata, but this represents simply the means of growth, for adult fat cells do not have the power to proliferate.

Embryologically, these neoplasms have repeatedly stimulated the study of the still unsolved problem of the origin of the fat cell. Keibel and Mall believe that the mesenchymal tissue differentiates into blood vessels, supporting fibrous tissue, and fat cells. They describe the process as follows: small granules appear in the cytoplasmic cellular substance which form into fat bodies, consolidate, and then become transformed into solitary lipoid masses which are then covered by a protoplasmic membrane. Jordan and Kindred state that the lipoblast is a mesenchymal cell in which fat globules are being elaborated in the following manner. There is first a budding of the chromatin substance of the nucleus with extrusion of the granules through the nuclear membrane. These granules are the primary fat bodies which gradually coalesce forming large drops of fat. Lewis and Stohr noted that in the 4 months' fetus, the fat cells are like the surrounding fibroblasts. Maximow considers the fat cell as being derived from the fibroblast.

The histogenesis of the fat cells and the mucin have given rise to considerable thought in relation to liposarcomata. Robertson submitted this question: "Do the lipomatous portions represent a fatty degeneration of the myxomatous tissues or vice versa?" He regarded each substance as a modification in the differentiation of mesoblastic cells and therefore as an independent type. Mallory maintains that the fat cell is a distinct type formed by differentiation from a mesenchymal cell and that it does not form a fibroblast. Jaffé regards the close relationship between mucinous and fat tissue during embryonic life as significant in these tumors composed of embryonic connective and fat tissue.

The case of Wells and Hirsch revealed some very interesting findings. Although the man was markedly emaciated, the retroperitoneal tumor

Fig. 1. One of the multiple transverse sections through the mammary gland showing two of the largest tumor masses replacing the greater portion of the breast. A well defined line of demarcation divides the nodes from the mammary substance.

weighed 69 pounds, the largest on record. Chemical examination revealed 2 pounds of fatty material and 4½ pounds of protein. There was a greater amount of sulphur, purin, and nitrogen than in the granuloma of swine. This latter fact, the authors believe, indicates that the tumor tissue is more embryonic than inflammatory.

The case to be reported presents several interesting features in that the tumor was located in the breast, a very rare, if not previously unrecorded location. Also, it was very malignant and occurred while the mother was nursing her child, thus affording an opportunity for the differential diagnosis of the so-called lactation tumors.

CASE REPORT

An Italian woman, aged 41 years, entered the surgical service of Dr. Raymond McNealy on June 5, 1928. She stated that she had given birth to a healthy baby 10 months before coming to the hospital. It was not until 3 months before admittance, or 7 months after the delivery of the child, that she noted small masses in both breasts. These tumors gradually increased in size but did not inconvenience her in any way and she was able to nurse the infant up to the time of her entrance into the ward.

Physical examination revealed multiple, somewhat soft and unattached masses in the substance of both mammary glands. The nipples were not retracted and there was no abnormal secretion from them. The overlying skin was not adherent to the underlying masses. The axillary lymph nodes were not enlarged.

The operative procedure consisted in the removal of both glands. Elliptical incisions were made about each breast. By blunt dissection both organs were separated from the surrounding structures. The fascia, pectoral muscles, and the axillary lymph glands were not removed. Approximation of the wound margins was obtained with ease by silkworm-gut sutures.

After operation her course was free from any complications except for a rise in temperature of 1 to 2 degrees the first few days. The wounds healed nicely with no discharge of milk from the lines of incision.

After she left the hospital, however, her course was progressively downhill. She was seen by Dr. McNealy on numerous occasions following the bilateral mammectomy. At these times he noted all the clinical manifestations of metastases to the lungs. The patient died 3 months after the operation.

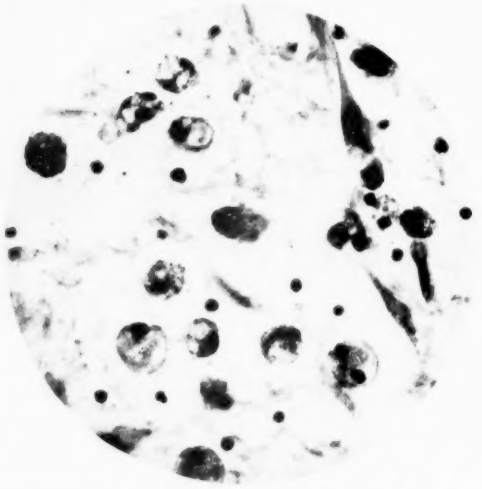

Fig. 2. Varying sized and shaped cells containing granules and lobules of fat. The loose reticular stroma with relatively few cells represents the less compact portion of one of the largest masses seen in Figure 1. Sudan III stain. ×300.

Macroscopical description (Fig. 1). Both glands were covered with coarsely wrinkled skin and presented 8 to 10 varying sized nodular elevations that were from 1 to 2 centimeters above the normal cutaneous surface. The nipples were not retracted nor was there any dimpling of the skin over the masses. Surfaces made by cutting revealed 10 round or ovoid bodies up to 5 by 4 by 6 centimeters in the left gland and 15 similar masses in the right. Three-fourths of the right and one-fourth of the left breast were replaced by these tumors. They were located at various depths but none were adherent to the overlying skin. All were well circumscribed from the surrounding mammary tissues by a whitish gray and firm structure that formed a membrane which varied from 1 to 2 millimeters in thickness. The nodes were composed of gray-white moderately firm material that was irregularly mottled, pale yellowish white. The cut surfaces of these portions were covered with a glairy, whitish-gray, syrupy, and tenacious mucoid substance. In the central portion of one of the larger nodes in the left breast there was a deep reddish purple and irregular area which measured 1 by 1.5 centimeters in diameter. The small amount of relatively normal appearing glandular substance was composed of pale yellow material through which, interspersed irregularly, were grayish white streaks and bands of firm tissue that varied from 0.5 to 1 millimeters in thickness.

Microscopic examination of sections taken from the whitish gray masses and the mammary substance revealed the *circumscribed masses* to be composed of areas varying in cellularity and the amount of intercellular substance, within the same tumor mass, leaving no vestige of mammary structure to be identified. The cells varied considerably in size in that their diameter ranged from 7 to 21 microns. In the regions where the intercellular stroma was most abundant, the cells were usually round or ovoid in shape but there were also elongated cells of spindle shape, which were most abundant, however, in the most cellular portions. A well defined membrane surrounded the cyto-

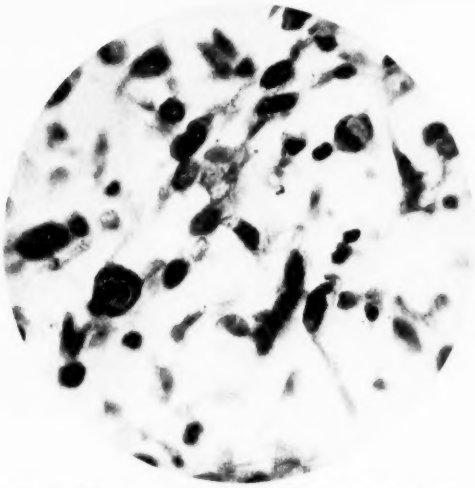

Fig. 3. Shows two mitotic figures in one of the smaller nodes. Hæmatoxylin and eosin stain. ×500.

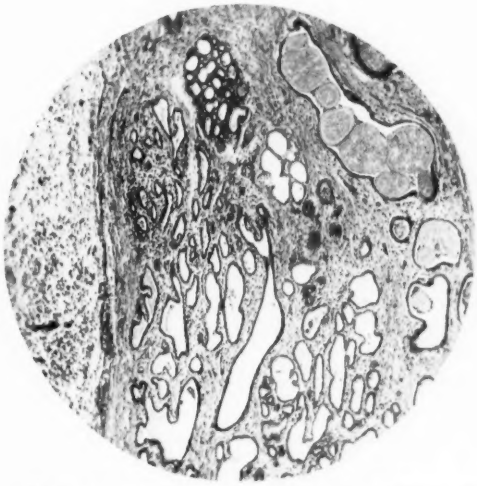

Fig. 4. A small amount of tumor tissue adjacent and separated from the actively secreting breast tissue by a well defined layer of connective tissue. Hæmatoxylin and eosin stain. ×28.

plasmic and nuclear substance. In the cytoplasmic portions were varying quantities of neutral fats which, in some cells, appeared as minute granules that were surrounded by acidophilic homogeneous material. Many of the cells, particularly in the portions where the stroma was less abundant, contained huge drops of fatty material with the nucleus of the cell located in the periphery. These huge intracellular accumulations of fat stained a uniform orange with Sudan III, but in other cells the large mass was composed of small accumulations of fat that were enclosed by a moderately distinct outer membrane. The spindle shaped cells, also, contained varying sized, minute, similarly staining bodies (Fig. 2). The nuclei usually corresponded to the shape and size of the cell, were rich in chromatin, and were surrounded by a well defined membrane. A distinct nucleolus with abundant chromatin occupied, most frequently, the central area of the nucleus. In the cells in which there was none or a very small amount of fat in the cytoplasm, were frequently found very small, well defined nucleoli-like bodies. These minute oxyphilic structures were located in the nuclear portions and varied from two to six in number. Most of these bodies were scattered singly in the nucleus but occasionally some were grouped just within the nuclear membrane, but none was found in the cytoplasm. In many of the cells that contained no fat in the protoplasm the nucleus appeared slightly vacuolated and in many the Sudan III had stained small round and ovoid areas a very pale orange color. Although mitosis was not abundant, various stages of nuclear division were seen (Fig. 3). The amount of intercellular material varied in inverse proportion to the cellularity of the masses. In the areas between the cells that were rich in fat many granules and globules of neutral fat were to be observed with a small amount of very delicate fibrillar connective tissue and occasional small groups of lymphocytes. An occasional capillary was seen coursing through the stroma. In the areas where the cells were less numerous, the fine connective tissue formed a meshwork in which there was a very finely granular substance that stained pale purplish blue with hæmatin.

The mammary substance (Fig. 4) was separated from the tumor masses by a connective tissue membrane which, nearest the nodes, was composed of loosely arranged and interweaving fibrils but adjacent to the mammary structures was more compact. The lobules were made up of numerous varying sized and closely packed alveoli that were lined with large, low, cuboidal cells. Many of the alveolar spaces were empty but others contained a finely granular acidophilic material with varying sized lipoid granules, lipophages, and a few lymphocytes. These products were also present in the lactiferous and interlobular ducts. The gray-white bands seen in the gross specimen were composed of dense connective tissue from which radiated similar, but thinner, septa that separated the glandular lobules. The capillary plexuses, venules, and lymphatics about the active alveoli showed no abnormalities.

The tumor in this case fulfills the usual criteria upon which the diagnosis of liposarcoma is based but its general behavior is somewhat different. The degree of malignancy is more marked than usual, for within the course of 3 months both mammary glands were involved. Although the neoplasms were well encapsulated and movable, metastases were present and resulted in the patient's death within 7 months after the first observation of the nodules in the breast. The rapid course can, to a certain extent, be explained by the increased vascularity and glandular activity of the organ during lactation, for it is generally accepted, as in carcinoma, that then there is a greater degree of malignancy. The emptying of the alveoli and ducts by the suckling of the infant undoubtedly had some effect upon the stroma in which the tumor cells were located, thus favoring their growth, extension, and dissemination.

Clinically, considerable difficulty in making a diagnosis is encountered. The usual tumors and tumor-like lesions of the breast in association with lactation were considered in the differential diagnosis. Chronic abscesses were out of the question in that there was no previous or present evidence of a localized inflammatory process or any so-called caking of the breast. Galactoceles are usually not so numerous and upon pressure there was no milk expressible from the nipple. Multiple cysts are not so firm and they usually transmit light. Lactation hypertrophy of numerous mammary adenomata was seriously considered, preoperatively.

The question arises as to the origin of the fat located in the cells of the tumor. Fatty degeneration can hardly be considered, for the cells have the properties of young fat cells. In addition, the presence of mitotic figures in regions that are not associated with any inflammatory changes indicates that one is confronted with cells that are rapidly growing and not in a state of degeneration. Against fatty infiltration, although the breast is an organ rich in fat and there is a hypercholesteræmia during lactation, is the fact that the intercellular areas where the cells contained the largest amount of fat were poor in this substance. Also the fibroblast is not possessed with even moderate phagocytic power. So little fat is present in these areas that it could easily be derived from the lipoblasts which have undergone disintegration. The presence of the extranucleolar granules and fat globules corroborates, to a certain extent, the statement made by Jordan and Kindred that fat globules are formed within the cells, coalesce, and appear as large fat bodies in the cytoplasm.

SUMMARY AND CONCLUSIONS

1. An unusual case of a liposarcoma is reported. The tumor was located in the mammary gland and occurred during the period of lactation in a woman 41 years of age.

2. The neoplasm is unusually malignant in a lactating breast, both locally and by means of metastases.

3. Additional evidence is submitted to the theory that the embryonic fat cell is derived from the undifferentiated mesenchymal cell.

4. Malignant tumors of the breast occurring during lactation are usually very difficult to diagnose, and radical surgical treatment must be instituted early to obtain satisfactory results.

5. Although a considerable amount of the mammary gland was replaced by the tumors, the function of secreting milk was still maintained.

6. Sarcoma of the mammary gland occurs in 2 to 3 per cent of all tumors of the breast but in no instance has there been any case of liposarcoma of the breast which could be found in the literature.

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SACROCOCCYGEAL TERATOMATA WITH MALIGNANT DEGENERATION IN CHILDHOOD

JOHN D. STEWART, M.D., NICHOLAS M. ALTER, M.D., AND JOHN D. CRAIG, M.D., NEW YORK
From the Departments of Surgery, of the Laboratories, and of Pediatrics, New York Post-Graduate Medical School and Hospital

TERATOLOGY embodies wide ranges of thought and commands a tremendous amount of space in medical literature. It is especially fertile in the various theories of causation and the variety of morphological structures and combinations observed. We shall limit our discussion to the teratomata of sacrococcygeal type that have undergone malignant degeneration in infancy and childhood.

REPORT OF CASE

O. S. (28712), a white male child, 2 years and 11 months of age, was admitted to the Post-Graduate Hospital on September 27, 1928. The familial and past histories were entirely negative. The child weighed 6 pounds 4 ounces at birth and the labor was normal.

The chief complaint was that 2 months prior to admission to the hospital, two hard lumps about the size of walnuts were noted in the right gluteal region. A few days prior to this the child fell a distance of three steps, landing in a sitting position.

Two weeks later, i.e., 6 weeks prior to admission, the parents noticed the stools to be ribbon-shaped on defæcation or, as they termed it "shaped like tooth paste coming from a tube." At this time the child when at stool would lean toward the left due to the progressively enlarging masses in the right buttocks. These symptoms persisted until admission to the hospital. The child's general condition was good. The head, neck, and thorax, including the heart and lungs, were essentially negative. The abdomen was slightly distended. The liver could be felt dipping down a breadth of a finger and a half below the right costal margin. The entire abdomen on palpation gave a doughy feel. There was a sensation of shotty nodular masses in both lower quadrants. In each inguinal region a large, stony, hard, movable gland, about 2 centimeters in diameter, could be felt. The genitalia were negative.

In the right gluteal region there was a noticeable protuberance making the buttocks asymmetrical and practically obliterating the right gluteal fold. The skin over this region was tense but not adherent to the deeper structures. Beginning at the level of the anus was a hard infiltrated mass about the size of a large orange. It was slightly movable and not tender or fluctuant. At the upper left portion of this mass there were superimposed two smaller masses, almond-sized and shaped and they were hard and moved freely over the surface of the deeper-lying larger mass. The masses did not move in synchrony with motion of the right thigh. About 5 centimeters above the anus was a small hole leading in toward the spine. The anus admitted the examining finger easily but almost immediately there was encountered a hard mass on the right side encroaching markedly on the rectum, pushing this viscus to the left, subsequently leaving very little lumen. The mass was smooth and there was no pain on examination nor was there any rectal bleeding following it. All of the deep reflexes were present and hyperactive except the right Achilles which was absent. No pathological reflexes were elicited. A tentative diagnosis of a teratoma that had undergone malignant degeneration was made.

On the first hospital day the blood count was: red blood cells, 4,330,000; hæmoglobin, 78 per cent; white blood cells, 10,200, with 53 per cent polymorphonuclear leucocytes and 47 per cent lymphocytes. The urine was negative. The stool showed a large amount of blood on chemical examination. The Wassermann test was negative.

On the third hospital day an X-ray examination of the chest for possible metastases was negative. A roentgenogram of the lumbar spine revealed "what may be a developmental defect in the last sacral segment and a sacrococcygeal area with a tumefaction of the soft structures over and below this area suggesting the likelihood of a spina bifida."

On the fourth hospital day the mass in the right gluteal region had grown to twice the size on admission and whereas heretofore the examining finger on rectal examination had been easily admitted, it now was admitted with difficulty. The rapid growth combined with a slight rise in temperature (100 degrees) and a leucocyte count of 13,100, with 72 per cent polymorphonuclear leucocytes and 28 per cent lymphocytes, made some of the attending physicians temporarily, at least, consider the possibility of an abscess.

On the sixth hospital day Dr. Stewart aspirated the sinus opening in the midline just above the anus and obtained no pus or fluid. He did a biopsy on the inguinal glands on both sides, the subsequent pathological diagnosis of which was metastatic papillary adenocarcinoma.

Pathological report by Dr. Ward H. Cook. "Gross: Five irregular, ragged, soft, hæmorrhagic portions of lymph nodes, replaced by tumor tissue, mucinous and necrotic in character, measuring, respectively, 25 by 20 by 13 millimeters, 20 by 18 by 12 millimeters, 19 by 16 by 10 millimeters, 14 by 14 by 12 millimeters and 15 by 14 by 6 millimeters. On section they are very friable, soft, and hæmorrhagic. Microscopic: The lymph node is entirely destroyed by an extraordinarily vascular, infiltrating new-growth composed of epithelial-like cells arranged for the most part in the form of irregular branching papillæ. Occasionally the cells are columnar in form and produce gland-like tubules. Mitotic figures are focally frequent. Sections from the skin show a communicating sinus lined with granulation tissue infiltrated with various forms of wandering cells including foreign-body giant cells. Sections from this region show no involvement by the tumor growth. Diagnosis: Papillary adenocarcinoma, metastatic. Note: Judging from the clinical history it is possible that the primary tumor will show multiple cell differentiation and prove to be essentially a teratoma."

In view of the diagnosis and the fact that the mass was becoming larger and encroaching more and more on the rectum, thus making obstruction subsequently inevitable, Dr. Stewart performed a colostomy on the thirteenth hospital day.

On the fifteenth hospital day a transfusion of 400 cubic centimeters of whole blood was given by the Unger method. The patient received routine care and in addition was placed in a tub of warm water for 10 minutes daily at the time the colostomy dressing was changed. The gluteal mass remained approximately the same size.

On the twenty-third hospital day X-ray therapy to the abdomen and gluteal region was instituted, subsequent treatments being given on the twenty-fourth and twenty-fifth hospital days.

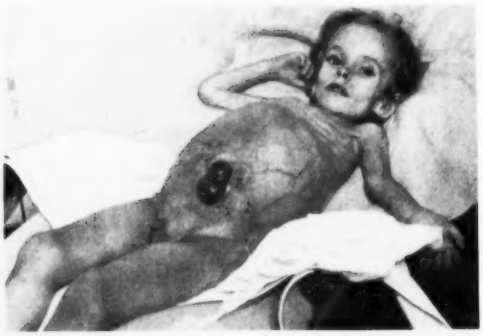

Fig. 1. Photograph of patient.

On the twenty-fourth hospital day, the white blood count was 12,750 with 77 per cent polymorphonuclear leucocytes and 23 per cent lymphocytes, while on the following day it was 5,000 with 71 per cent polymorphonuclear leucocytes and 29 per cent lymphocytes, showing plainly the effects of the roentgen therapy. The patient spent the better portion of each morning on the roof getting the benefit of the sun's rays through a Vita glass solarium. Following the X-ray therapy the gluteal mass became progressively smaller until on the thirty-fourth hospital day the examining finger, on performing a rectal examination, could again be introduced without difficulty.

On the forty-first hospital day and subsequently there was marked abdominal distention.

On the forty-second hospital day the blood count was: red blood cells, 3,900,000; white blood cells, 7,600, of which 74 per cent were polymorphonuclear leucocytes and 25 per cent lymphocytes, with one eosinophile. The hæmoglobin was 70 per cent and the blood calcium 12.1.

On the forty-sixth hospital day, on abdominal examination, a mass could be felt in the right lower abdominal quadrant following the ascending colon. It was superficial and apparently about the size of an orange. The abdomen was markedly distended and presented on its surface a network of engorged veins. The gluteal mass had so diminished in size that on rectal examination it was barely discernible. A blood count revealed 9,400 white blood cells, of which 67 per cent were polymorphonuclear leucocytes and 33 per cent lymphocytes. The hæmoglobin was 8.7 (Newcomer). From this time on the child became progressively weaker, the abdomen at the same time becoming more distended. He complained of diffuse abdominal pain.

On the sixtieth hospital day an X-ray film taken of the chest for possible metastases was negative.

On the sixty-first hospital day a stool examination revealed a large amount of blood. From this time on the stools varied in color from a brown to a frank black.

On the sixty-seventh hospital day the red blood cell count was 2,450,000 with a hæmoglobin of 46 per cent. The child became progressively more emaciated and weaker and on the seventy-fourth hospital day a transfusion of 300 cubic centimeters of whole blood was given by the Unger method. Tenseness and enlargement of the abdomen in contradistinction to the marked emaciation of the other parts of the body became more pronounced. Large quantities of blood were lost in the stool and the abdominal veins became more engorged.

On the ninetieth hospital day the child began vomiting parts or all of each feeding, this persisting until death.

On the ninety-fifth hospital day, the blood count was: red blood cells, 3,750,000; white blood cells, 7,400, of which 70 per cent were polymorphonuclear leucocytes and 30 per cent lymphocytes; and the hæmoglobin was 60 per cent. The child became progressively weaker and died on the one hundred and eighth hospital day, at the age of 3 years and 3 months.

Autopsy report. Gross autopsy findings: Body is that of an extremely emaciated white male child, 3¼ years, 91 centimeters long, slightly icteric. Pupils are regular, equal and markedly dilated, 7.5 millimeters in diameter. The superficial lymph nodes—supraclavicular, axillary, and inguinal—are palpable, about the size of a split pea. There are old venipuncture marks in both cubital fossæ. The abdomen is markedly protuberant. On the lower thorax and upper abdomen are several dilated superficial venules. Slightly above and parallel to each Poupart's ligament is a fine linear scar, right 2.5 centimeters long, left 2.4 centimeters. In left lower quadrant is an old patent colostomy with two openings, the whole measuring 5 by 3 by 2 centimeters. Posteriorly at the level of the first lumbar vertebral spinous process is a right paramedian shallow decubitus ulcer 9 millimeters in its widest diameter. In the intergluteal fold, 3.5 centimeters from the anus is a linear scar 1.5 centimeters long, at the superior end of which is a noticeable dimpling. Both lower extremities up to the crest of the ilium show marked pitting œdema. The scrotum is likewise moderately œdematous; there is a slight right hydrocele.

The primary incision extended from the suprasternal notch to the symphysis pubis. The panniculus adiposus over chest is represented by a very thin, œdematous, grayish tissue with few small fatty lobules in it. The dome of the diaphragm reaches the third rib on the right, the fourth on the left.

No free fluid is found in the chest. The inferoposterior portion of right lower lobe is dark red and somewhat œdematous. No gross areas of consolidation are observed. The postero-inferior edge of this lobe contains a grayish, firm, very cellular, metastatic nodule 2 by 1.5 by 1 centimeters. There are five other smaller injected nodules scattered here and there in this lobe subpleurally. Another large nodule, 1.2 by 1 by 0.5 centimeters, is present in the antero-inferior edge of the left lower lobe, and is surrounded by a thin zone of hæmorrhage. The pericardial sac contains a little clear straw-colored fluid. The heart measures 5 by 4 by 3 centimeters. The foramen ovale is patent. No other abnormalities are found.

The abdomen contains about 200 cubic centimeters of sanguinolent fluid, non-flaky, but the visceral and parietal peritoneum is smooth and glossy. The internal inguinal rings are closed. The gastro-intestinal tract shows nothing remarkable grossly except that the colostomy openings have been made 12 centimeters from the anal sphincter. The appendix is grossly normal, 5 by 0.4 centimeters. The liver, 24 by 17 by 10 centimeters and weighing 1,540 grams, occupies most of the abdominal cavity, extending 12 centimeters below the costal border in the right anterior axillary line, 9 centimeters in midline and 4 centimeters in the left anterior axillary line. Its surface is roughly nodular, due to numerous single and conglomerate, very cellular islands of tumor tissue, gray, yellowish, or green in color, with or without small specks of hæmorrhages into their substance. The largest single nodule measures 2.5 centimeters in diameter. The surrounding compressed liver parenchyma is either dark red, yellow, or green in color, so that the whole organ presents a variegated intermixture of colors. The gall bladder is small, being filled with about 5 cubic centimeters of clear amber bile. The bile ducts are patent. The spleen, 8.5 by 5 by 2.5 centimeters, weighing 40 grams, is

grayish purple in color and soft. The trabeculæ are prominent. The malpighian bodies are not evident. The left kidney is wholly absent. The right kidney, 9 by 5.5 by 4 centimeters, shows well defined fetal lobulations after the capsule has been stripped easily. On section the renal pelvis contains much irregular, sandy, crumbly sediment. Its mucosa is but slightly injected. The ureter is not dilated although the ureteral opening into the bladder is occluded by a small grayish calculus. The left corresponding opening is absent. Between the sacrococcygeal bones and the rectum and strongly adherent to both is a yellowish, very fibrous mass, 3.5 by 5 by 3 centimeters, containing several pea sized, discrete, gray nodules of tumor tissue. The rectal wall and mucosa are not involved by this growth. There is no thrombosis of the iliac vessels. The mesenteric and retroperitoneal lymph nodes are soft, gray, and measure not more than 7 millimeters in their long diameters.

Anatomical diagnosis: sacrococcygeal carcinomatous teratoma with metastases to liver, lungs, and inguinal nodes. Aplasia of left kidney. Status post-colostomy.

Microscopic findings. Thymus: little lymphoid tissue is seen. The Hassal's bodies are large. There is marked fibrosis. The muscle heart fibers are uniform in size. There is distinct striation everywhere. Sections of the lung show some bronchi with hæmorrhage and exfoliated epithelium. Most of the air spaces are air-containing. Some of the lung sections show an irregular epithelial growth that shows glandular structure everywhere. The cells in the stained preparation are partly dark and small. Others are rather pale and large. There is also a great variety in the nuclei. Some of them are small and dark, others are vesicular. Sections of liver show very marked fatty changes. There are only dark-stained trabeculæ along the periportal spaces. Liver cells are large, pale, and foamy. Irregular areas of liver tissue are replaced by epithelial growth which is glandular in arrangement. The cells are cuboidal and have large vesicular nuclei. There are very numerous mitotic figures. Sections of the kidney show well preserved structure. The epithelial cells of the tubules are somewhat swollen. There are no glomerular changes seen. Sections of small intestine show congestion of the submucous vessels. Section of the sacrococcygeal tumor shows a great variety of tissues. These are derived apparently from all three germ layers. There is striated muscle as well as cartilaginous tissue, also a great deal of embryonic fatty tissue where the pale fat cells have almost central nuclei. There are also irregular areas with large pale cells with vesicular nuclei and small nucleoli. These are evidently nerve cells. Most of the section is taken up by a malignant epithelial growth, very undifferentiated. The origin of these cells is obscure as they do not resemble any mature cells. They are cuboidal, dark-stained, and show numerous mitotic figures. The glandular arrangement is everywhere well preserved.

Autopsy diagnosis: sacrococcygeal carcinomatous teratoma with metastases to liver, lung, and inguinal nodes; aplasia of left kidney; status post-colostomy.

Teratomata are not uncommon and may occur anywhere in the body, the sacrococcygeal and anorectal regions being the most frequent sites (6). For a discussion as to etiology and experimentology on the subject the reader is referred to Bosaeus's excellent paper.

That teratomata of the sacrococcygeal and anorectal regions show a tendency to undergo malignant changes and that when this occurs in children the phenomena are fulminating is conceded by the profession. This is borne out by Gant who says that "teratomata of the sacrococcygeal and rectal regions show a tendency to undergo cancerous degeneration unless evacuated or removed early," as well as MacCallum (7) who writes, "It is of interest here as an example of the contributory causes of tumor growth to recall the fact that malignant tumors frequently develop from one tissue of a teratomatous growth and metastasize alone, although in the absence of this specific change such teratomata are benign." This, of course, is true. However, our search of the literature gives a different impression, as only 4 cases of sacrococcygeal teratoma which had undergone malignant degeneration in childhood were reported and only two of those were pathologically above reproach. In the two others the pathologists were satisfied in saying that the tissue "suggested carcinoma." These cases will be described in detail in the end of this article.

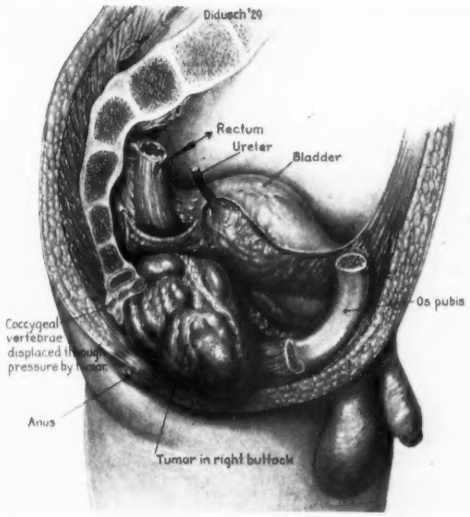

Fig. 2. Drawing showing pathological condition found at autopsy.

The chief complaint is usually that of a tumor seen or felt, or of constipation, the latter varying from the simple type of that in which the patient infrequently passes ribbon-like stools due to the distortion of the rectal lumen from encroachment of the neoplasm, as in our case. Occasionally the mass may be situated in such a manner or be of such a size as to present the syndrome of intestinal obstruction as was the case in Sawday's report and which would have been inevitable in our case had a colostomy not been done.

The degree of symptomatology is widely variable (Gant) as the tumor may be single or multiple, small or large, unilocular or multilocular; it may have thick or thin capsule, be located extrarectally, in the bowel, upon the surface of the sacrum or coccyx, or between the anus and sacral tip; may be round, lobulated or pedunculated, or exist as sinuses or as simple dermoid cysts situated posteriorly in the median line or sacrococcygeal crease.

If these tumors be considered as congenital anomalies, as most authors do consider them, an accompanying anomaly should be searched for and ruled out. Our case had an accompanying spina bifida. The importance of finding a secondary congenital anomaly accompanying an obvious one is made clear by De Sanctis and Craig.

The treatment is radical surgery, the tumor being removed *en masse* whenever possible. If there be metastases, palliative treatments by X-ray or radium are used and complications such as intestinal obstruction are treated by palliative measures as they present themselves.

The prognosis when malignancy has ensued is practically fatal but if every teratoma is considered a potential malignancy with a fatal outlook and removed whenever possible prophylactically, the sparse number of these pitiful cases will be still further reduced.

The other pathologically undisputed cases of malignant teratomata (sacrococcygeal) in children were the first of 2 cases reported by Fletcher and Waring and one reported by Pandali, Forsyth, and Stewart.

Fletcher and Waring's case was a boy 2 years of age, in whom a tumor about 3 inches in diameter was found on the left side by rectal examination. It projected and pushed the rectum forward. The growth together with the rectum was removed. The child was re-admitted in 2 months with extensive intrapelvic recurrence and enlarged lumbar and inguinal nodes. The child died 3½ months after operation. The mass was partly solid and partly cystic and lay immediately under the skin, which was not involved. The soft solid portion was found to be adenocarcinoma, the recurrence in the nodes having the same structure.

The case of Pandali, Forsyth, and Stewart (8) was almost similar pathologically. The patient was a 12 months' male infant. The chief complaints were retention of urine which could not be relieved by a catheter and difficulty in defæcation. On rectal examination half an inch above the anus, a lobulated swelling, about one inch in diameter, could be felt posteriorly. It pushed the rectum forward. After enucleation of this mass, the child died and no autopsy was obtainable. Referring to the pathological examination of the mass they go on to say that microscopically the bulk of the tissue is of two kinds corresponding in the main to the two varieties seen by the naked eye. The firm portions, in which small cysts lie, are teratomatous, the soft friable parts of the cyst wall are composed of intracystic papillary adenocarcinomatous tissue, showing all stages of transition from the aforementioned simple villous papillomata to frankly malignant tissue.

The two other cases were as follows: A "sacroteratoma" described by Leopold and Phillips from a stillborn child had a complex structure. It was 5.6 by 2.8 inches and contained bone, cartilage, fat, muscle, fibrous tissue, lung, digestive tract, retinal pigment, and glandular tissue. One area suggested carcinomatous change.

Sawday's case was a boy 4 years and 5 months of age, showing partial intestinal obstruction due to a post-rectal teratoma. As in our case, on rectal examination the pelvis was found to be filled with a hard mass lying behind and somewhat to the left of the rectum. An exploratory laparotomy showed a retroperitoneal mass. Biopsy showed "a remarkable new-growth consisting of a mass of tissue which, on close inspection, was seen to be made up of small papillary outgrowths of fibrous stroma covered with epithelium of an elementary type. It is practically certain that this is part of a teratoma. What the tissue is it is impossible to say. It is too slightly differentiated to have a special function or name; this may be the main element of its malignancy which is evidently of a high order. If the entire aberrant mass could be examined, there is little doubt that other tissues would be discovered though in the case of a malignant overgrowth of teratomatous tissue it is quite usual for one type to become considerably more increased than the remainder." The child died 17 days later and on autopsy the tumor showed various tissues, including muscular, nervous, and epithelial cells all in a primitive state of development. There was cartilage and a calcified area in the section. He proceeds to say: "It would appear to be a matter of doubt whether this tumor was highly malignant or benign. Some of the sections suggest the former but several cases have been described in which similar tumors have eluded discovery until fairly late in life."

SUMMARY AND CONCLUSIONS

1. A case of malignant degeneration of a sacrococcygeal teratoma occurring in childhood is herein reported.

2. This phenomenon is not so common as is generally thought or else the cases are not reported in the literature as they should be.

3. Every sacrococcygeal teratoma in childhood should be considered a potential malignancy and prophylactically excised whenever possible.

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THE BIFURCATION OPERATION

Indications, Technique, and Results

WALTER I. GALLAND, A.B., M.D., New York
Assistant Attending Orthopedic Surgeon, Hospital for Joint Diseases; Assistant Orthopedic Surgeon, Lenox Hill Hospital

IN 1919 Lorenz published an operative procedure on the hip to which he applied the descriptive term "bifurcation." In this operation the upper end of the femur is converted by osteotomy into a two pronged fork. The medial prong of this fork rests against the acetabular area of the pelvis, and serves as a new weight bearing head. The lateral prong of the fork contains the trochanteric portion of the femur and serves as a muscle lever through which the extremity is eventually activated.

This procedure was first recommended for use in irreducible congenital dislocations of the hip, and also in cases of ununited fracture of the neck of the femur. Upon first glance the operation seems grossly irrational and un-anatomical, and it has been quite generally condemned upon these grounds. However, the striking results of the procedure have gradually been breaking down this once uncompromising opposition, and it is now being more widely accepted as an outstanding contribution to the surgery of the hip joint.

Since the operation was first proposed, there has been a gradual widening of the indications for its employment, and we now recognize its value in a wide variety of conditions affecting the hip.

The operation is, upon close analysis, neither illogical nor un-anatomical, but is based upon solid anatomical and surgical considerations. Used in conditions in which there is a disorganization of the hip joint, the operation aims to create a stabile, mobile and painless joint, not by attempting a plastic duplication of a normal joint, but by constructing a neo-arthrosis, which will support the body upon a solid unbroken femoral shaft in such a manner as to exclude the pathological area from weight bearing.

The logic of the operation can best be appreciated by considering the indications for its use and the manner in which the bifurcation achieves results in each case. Briefly stated, the operation is indicated in conditions in which there is instability of the hip joint by virtue of irreducible dislocation, ununited fracture, or a disorganizing or inflammatory process. In all of the conditions, which will be specifically mentioned below, the outstanding indication for the operation is pain.

The indications can be considered under three headings: (1) dislocations of the hip, traumatic, congenital, or pathological; (2) ununited fractures of the neck of the femur and allied conditions; and (3) inflammatory processes involving the hip joint.

1. *Dislocations of the hip.* Under the first heading (Fig. 1) we must include irreducible congenital dislocations of the hip, pathological dislocations of the hip, and irreducible traumatic dislocations. In all of these cases the mechanical insufficiency of the hip is based upon similar anatomical conditions. The body is deprived of direct support through a total absence of contact between the pelvis and the femur. The body is slung upon the pelvitrochanteric muscles and the stretched capsular and ligamentous structures of the hip. By reason of the absence of unbroken osseous support, the patient exhibits telescoping movement of the femoral shaft, and the Trendelenburg sign, that is, sagging of the pelvic basin upon bearing weight on the pathological hip. The musculoligamentous sling which bears the thrust of the body weight becomes stretched and fatigued, and eventually a train of painful manifestations develop which complete the incapacitation of the patient.

In all such conditions the bifurcation relieves the mechanical factors which cause the disability. The shaft of the femur is osteotomized in an oblique direction at the level of the acetabulum, and the upper, pointed end of the distal fragment is thrust into the acetabulum invaginating before it the capsular structures which intervene. The trochanteric fragment of the femur unites with the shaft and constitutes the second prong of the fork, which completes neo-arthrosis. The body weight is supported on the unbroken femoral shaft. The capsule, which intervenes between the upper end of the shaft and the acetabulum, prevents a union between pelvis and femur and insures motion. The muscles attached to the greater and lesser trochanters remain attached to the same structures, and through them the shaft is activated. Thus the body has gained support at its normal point of support, the acetabulum; telescoping movement of the femur cannot occur; the muscles and ligaments are relieved of the strain of supporting the body weight; the Trendelenburg sign disappears; and painless motion and locomotion are secured.

2. Ununited fractures of the neck of the femur, and allied conditions. Under this heading, the bifurcation is applied to conditions in which there is a disturbance of the mechanical integrity of the hip, due to a severance of the continuity of the neck of the femur (Fig. 2). In addition to fractures of the neck, such conditions as complete epiphyseolysis and coxa vara luxans are included. In the latter condition, the coxa vara is of such an extreme degree that under weight bearing a virtual subluxation of the hip occurs.

In these patients too, the thrust of the body weight falls upon the musculoligamentous structures surrounding the hip, and eventually pain, which in many cases completely incapacitates the patient, results. In common with the dislocations, these patients exhibit telescoping movements of the femur and the Trendelenburg sign, though to a lesser extent. They differ from those of the first group, in that the acetabulum is occupied by the head of the femur, instead of being empty.

The operation in such conditions aims to exclude the pathological cervical area from weight bearing and to re-establish an unbroken support for the body at the normal area of support, the acetabulum. The femur is severed obliquely at the level of the lower margin of the head, and the two pronged conformation is established, the medial prong resting directly under what may well be termed the chin of the head. Here too the capsular structures of the joint intervene between the upper end of the shaft and the acetabular structures. (Fig. 2). The trochanteric prong becomes the activating muscle lever, and the body weight is supported at the acetabulum by an unbroken shaft of the femur. Motion is insured by virtue of capsular interposition, and all the telescoping movement of the femur is overcome. The pathological neck is, as it were, shunted out of function, and painless motion, locomotion, and weight bearing are secured.

3. Inflammatory processes involving the hip joint. Here we have a wide, and it must be said a growing, group of indications for the bifurcation. Perhaps in this category these indications are not quite so clear cut, and each case must be considered from all aspects. In general, we can say that the bifurcation can be recommended in painful conditions of an inflammatory nature, in which an exclusion of the pathological joint from weight bearing is deemed advisable. In addition to these cases, are those with inflammatory conditions which endanger the stability of the hip joint by disorganizing its constituent parts. The inflammatory conditions which have been considered in special cases as being subject to amelioration by means of the bifurcation are (Fig. 3) (a) arthritis deformans, (b) tuberculosis of the hip, and (c) Charcot's disease of the hip.

Fig. 1. The bifurcation as applied to congenital, traumatic or pathological dislocations of the hip and to all other cases in which the acetabulum is empty. It will be noted that the osteotomy is entirely extracapsular, and that after displacement the capsule intervenes between the upper end of the distal fragment and the acetabulum. The arrows indicate the level and the line of osteotomy in each case. *A* represents the osteotomy as modified by Hass.

In all of these cases the object of the operation is to relieve the pathological area from function, and to re-establish support through the femoral shaft by means of the bifurcation. It must be emphasized that under no circumstances should the method be used in cases in which there is ankylosis of the hip, as in such cases motion will not be re-established.

The design of the bifurcation must be modified to some extent in cases coming under group 3. The purpose of the operation is altered somewhat, as the instability and painful manifestations in these patients result from intra-articular pathology; and, therefore, to relieve the pain, the articular area itself must be relieved from weight bearing. In the cases previously considered (groups 1 and 2), the upper end of the lower fragment is dislocated directly into the articular area.

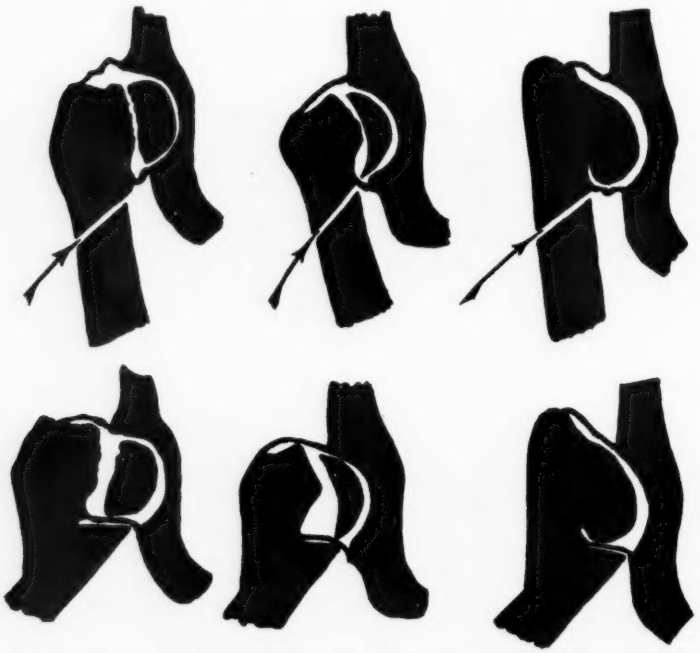

Fig. 2. Diagrams illustrating the use of the bifurcation as applied to cases falling in group 2, i.e., ununited fractures of the neck of the femur, and allied conditions. Note that in all of these cases the upper end of the lower fragment is displaced directly under the "chin" of the femoral head, and that the capsule intervenes between the upper end of the distal fragment and the head. The arrows indicate the level and the line of osteotomy in each case.

In cases with intra-articular pathology, such a procedure would fail to achieve results, as the pathological area would continue to bear weight, and, therefore, continue to cause pain. If the displacement in these cases is made, not into the acetabular area, but rather just below the rim of the acetabulum on the body of the ischium, then the joint area is shunted out of its weight bearing function, and the stresses falling through the neoarthrosis are painlessly borne. This changed displacement is illustrated in Figure 3.

In cases of arthritis deformans, pain is to be considered the outstanding indication for the operation. By transferring the weight bearing function from the pathological head to the neoarthrosis produced by the operation, we can definitely alleviate the pain, while we can preserve to a large extent the motion of the hip.

In tuberculosis of the hip, the operation may be considered in those cases in which there is wandering of the acetabulum with destruction of the acetabular-capital area. In these cases, as explained above, the aim is to lodge the upper end of the distal fragment directly under the rim of the acetabulum. It is still a question among those who have had experience with the operation, as to whether early intervention in a tuberculous hip might, by throwing the pathological area out of function, cause a recession of the disease.

In cases of Charcot hip the operation can be used with considerable circumspection. Here, too, the hip is stabilized by means of the bifurcation, although the question will always arise as to the possibility of the failure of union between the trochanteric fragment and the shaft. If this union should fail, the operation will be a failure from the standpoint of both stability and function.

THE OPERATION

The site of election for the osteotomy is determined from the X-ray picture, the distance being measured from the tip of the great trochanter, and it is well to bend a flexible probe to indicate both the level and the direction of osteotomy, to serve as a guide at the time of operation.

Fig. 3. The bifurcation as applied to cases of inflammation involving the hip joint. In these cases the upper end of the lower fragment is displaced against the lower acetabular margin, so that the pathological acetabular region receives none of the thrust. The arrows indicate the level and direction of osteotomy in each case.

The patient is placed on the sound side with the pathological hip slightly flexed, and a loosely packed sand bag is placed between the thighs. An incision is made from a point 1 inch above the tip of the great trochanter downward over the lateral aspect of the femur for a distance of 6 inches. The fascia lata is incised along this line and the muscles are divided bluntly in the line of their fibers, thus exposing the femur. Lane retractors are placed under the femur thus elevating it in the wound and protecting the deeper structures from injury. The site of osteotomy is determined by means of the previously sterilized bent probe, and at the site of election a smooth oblique osteotomy of the femur is performed. The line of this osteotomy should run upward and inward toward the acetabulum and should divide the femur so that most of the lesser trochanter remains with the upper fragment. This is important, because in the bifurcated hip the trochanteric fragment serves as a muscle lever and should contain the attachment of the iliopsoas muscle. After the femur has been divided, the osteotome is held in place, and the lower fragment is abducted by the assistant, or preferably by the operator, because this is the most important step of the operation. Upon abduction the divided extremity of the shaft slides along the osteotome blade, and dislocates inward toward the acetabulum. The osteotome is then removed, and the position of the pointed extremity of the shaft is verified and improved by digital inspection. The thigh is brought into 40 degrees of abduction and 10 degrees of flexion. This will bring the cut surface of the trochanteric fragment in apposition with the lateral aspect of the shaft of the femur. It has been the recent practice of the writer, due to one case from the service of Dr. Leo Mayer, in which union failed to occur between the two fragments, to roughen the outer surface of the upper end of the distal fragment by means of an osteotome, so that chips of bone are raised from this portion of the shaft which comes in contact with the cut surface of the upper fragment. This provides a better stimulus for osteogenesis and favors more certain and firmer union, while adding no new technical difficulty to the operation. The wound is closed in layers. There is no necessity for suturing or

nailing the two fragments together, as union between these parts takes place without this.

The thigh is placed in a plaster spica bandage reaching from the ribs to the toes. The thigh should be in full 40 degrees of abduction, 10 degrees of flexion, and slight external rotation.

In cases in which the acetabulum is fairly well formed and is not occupied by the head, that is in cases of congenital and pathological dislocation of the hip, Hass, of Vienna, modifies the line of osteotomy. His line of division in these cases is performed with the apex at the level of the acetabulum and the line of osteotomy extending from this level in the coronal plane downward and posteriorly. Upon abduction the cut surfaces of the two fragments remain in apposition and an angulation is formed, which is placed in the acetabulum, and which functions as the weight bearing head (Fig. 5). This method is perhaps somewhat more difficult to consummate, and has as its principle advantage a saving of a few centimeters in the length of the extremity. It also gives a somewhat smoother weight bearing head as an end-result. It is perhaps best in most cases, however, to adhere to the original line of oblique osteotomy in the sagittal plane.

AFTER-CARE

The patient may be permitted out of bed in the full cast in 3 weeks and allowed to walk with crutches. At the end of 6 to 8 weeks, the spica is shortened to the knee, and weight bearing with crutches is continued. At the end of 3 months the cast is removed, and massage and exercises, particularly of the abductors of the thigh, are given.

RESULTS

The bifurcation operation in properly selected cases yields surprisingly good functional and cosmetic results, although it should never be recommended purely upon a cosmetic indication, as a certain amount of shortening always results. The operation is designed primarily for the purpose of re-establishing painless function. After due time has been allowed for proper after-treatment, we can expect that the extremity will function painlessly and that the mechanical capacity of the hip joint for weight bearing will be re-established. The motions of the bifurcated hip are for the most part surprisingly free; flexion of the hip can frequently be accomplished past a right angle from full extension; abduction can be expected to approximately 40 degrees. Rotation of the hip, however, is almost absolutely restricted. The shortening which ensues as a result of the operation is not as great as might be expected, and is considerably masked by the abducted position of the hip. It will be evident from studying the diagrams and X-rays presented with this article that the upper level of the lower fragment is displaced in most cases almost horizontally inward, and that the upward displacement is in most cases very slight. The actual additional shortening amounts to considerably less than an inch. Most of the hips which are bifurcated are in some degree of adduction contraction prior to operation with a resultant apparent shortening due to this deformity. The establishment of an abducted position of the thigh will create an apparent lengthening of the extremity which will mask to a very considerable extent the moderate additional actual shortening produced by the bifurcation.

The gait of the patient following operation is for the most part very satisfactory. The pelvis on account of the abducted and shortened extremity is moderately tilted toward the pathological side, but this can be overcome to a large extent by a concealed raise in the shoe. Since the body has regained a solid bony support, the Trendelenburg sign disappears. Progression up and down stairs is frequently possible in normal manner. In the more or less rare cases in which a bilateral bifurcation is performed, if care be taken to make the osteotomy at precisely symmetrical points, an excellent cosmetic result can be predicted.

The results in cases of elderly people with ununited fractures of the neck of the femur are surprisingly gratifying. The operative shock is negligible, the patient can, if necessary, be placed in an upright position out of bed on an improvised stool made from a motorcycle saddle if hypostatic pneumonia is feared. At the end of 6 to 8 weeks, when the cast is shortened to the knee, these elderly patients can be up and about on crutches. With proper handling, the mortality in such cases, even in advanced years, is surprisingly low.

COMPLICATIONS

There are very few untoward incidents which are likely to result from the bifurcation. As has been mentioned before, very little shock is to be expected. The loss of blood is minimal, and postoperative pain is rarely a serious complaint.

There is one complication which can easily be avoided. The upper, pointed extremity of the femoral shaft in most instances comes to rest directly beneath the femoral vessels in the acetabular region. This fragment of the femur, if displaced anteriorly, may impinge upon or even conceivably perforate these vessels. Even a moderate impingement may seriously compromise

the circulation in the extremity. For this reason the operator must be sure not to displace this fragment anteriorly. This is avoided by flexing the thigh while it is being abducted, and placing the thigh in at least 10 to 15 degrees of flexion in the final plaster bandage. This will insure the integrity of the vascular supply of the extremity.

A second complication, which is perhaps more difficult to avoid, is that of non-union between the shaft and the trochanteric fragment of the divided femur. This is an extremely rare occurrence, but at least one case has been called to my attention in which it has occurred. Non-union in these cases is synonymous with failure, as the femoral shaft then lacks the necessary muscular attachments to insure useful motion, and the stability of the displaced upper end of the shaft is extremely insecure. Non-union can be best avoided by insuring good apposition between the trochanteric fragment and the shaft, and also by maintaining the primary plaster bandage intact for fully 6 to 8 weeks before shortening to the knee. In cases in which the cast is shortened too soon, there is danger that the thigh with the entire lower fragment will rotate externally, completely dissolving contact between trochanter and shaft. If non-union should occur, it is perhaps wisest to attempt to secure union by exposing the trochanteric area, and pegging or screwing the trochanter to the lateral aspect of the shaft after both surfaces are freshened.

CASE REPORTS

Case 1. Miss M. H., aged 59 years, was admitted to the Lenox Hill Hospital on the orthopedic service of Dr. Charles H. Jaeger on April 4, 1925, with the diagnosis of ununited fracture of the neck of the femur. The patient had fractured her femur a year prior to admission and had been treated in various New York hospitals, including an orthopedic institution. She was suffering from incessant pain day and night upon admission, and walked only with the greatest difficulty. She was emaciated and her general physical condition was poor. On April 13, in conjunction with Dr. Jaeger, a bifurcation was performed upon the fractured extremity. The upper extremity of the shaft was displaced directly below the head of the femur. There was no postoperative shock and but little pain; in fact, this patient was almost immediately relieved from the intense pain, which she had been enduring since her injury. Three weeks after the operation this patient, walking with the aid of crutches, was demonstrated before the Orthopedic Section of the New York Academy of Medicine. The cast was shortened to the knee at the end of the sixth week, and removed 3 months after operation. She was discharged from the hospital on July 26, walking with the aid of a cane. The final X-ray pictures showed that in the spica the patient had lost a considerable amount of abduction, which had been established at operation, and in consequence there was some impairment of the expected motion in the bifurcated hip. Upon last examination the patient walked with a moderate limp, with the pelvis tilted toward the pathological side, but she used no crutch or cane. The hip was absolutely painless and had been so since operation. Only about 10 degrees of flexion and 10 degrees of abduction were possible, this limitation of motion being to a considerable extent due to the failure to maintain the full abducted position of the lower fragment in the spica. Progression up and down stairs was possible, one step at a time. In spite of the deficient motion the patient is highly pleased with the result.

Case 2. M. S., school girl, aged 10 years, was admitted to the Hospital for Joint Diseases, on the service of Dr. Finkelstein on September 21, 1925, with the diagnosis of chronic infectious arthritis of the right hip. The disability started when patient was 3 years old, at which time she had severe pain in the hip joint. She was treated in the Hospital for Joint Diseases. A suppurative process was present in the hip, which was drained, and the child was placed in traction, and subsequently permitted to walk in a caliper brace. At the time of the present admission, the child walked with a marked right hip limp with extreme lordosis. There was a flexion contraction of the right hip of approximately 30 degrees. The motions of the hip were painless and free, except for the flexion contraction. There was a shortening of 2½ inches of the right lower extremity, and marked atrophy. The X-ray examination showed destruction of the head and neck of the right femur with upward displacement of the trochanter. The child was first treated for the flexion contraction of the right hip. On September 24, 1925, a Soutter fasciotomy was performed on the right hip, and the flexion deformity was corrected. The child was subsequently placed in traction, and the shortening of the extremity was reduced as far as possible. On April 1, 1926, a bifurcation operation was performed on the right hip, and the extremity was put up in a plaster spica bandage in 40 degrees of abduction and 10 degrees of flexion. The spica was removed, and the position was verified on May 13, and at this time a short spica, extending to the knee, was applied, and the patient was permitted to walk with crutches. The spica was removed at the end of the third month, and the child was given the usual massage and abduction exercises. At no time during the postoperative treatment was there any considerable degree of pain or discomfort. When last seen, approximately 1 year and 8 months after operation, the child had recovered almost full functional use of the extremity. Approximately 1 inch of shortening was present. The calves on both sides measured the same. Flexion of the thigh was free to 90 degrees, abduction to 30 degrees, rotation was limited. The child walked with the pelvis tilted somewhat toward the right side, but stood without exaggerated lordosis, and walked up and down stairs with normal progression. There has been no pain in the hip since operation.

Case 3. Mrs. R. A., housewife, aged 46 years, was admitted to the Hospital for Joint Diseases, May 7, 1926, with the diagnosis of marginal subluxation of the left hip. The patient had limped since birth, and for the past 18 years had had pain in the left hip, which was rapidly getting worse. The patient was unable to walk without the aid of a cane. Physical examination revealed extreme limitation of motions in all directions in the left hip. This was due to painful muscle spasm. The X-ray film showed a marginal subluxation of the head of the left femur. On May 13, 1926, a bifurcation was performed on the left hip, Dr. I. S. Tunick assisting. The line of osteotomy was calculated so that the upper tip of the distal fragment was on the level with the lowermost margin of the head of the femur. The femoral shaft was displaced inward, so that its proximal extremity rested in the lower portion of the acetabulum. A spica was applied with the hip in about 15 degrees of flexion, 40 degrees of abduction. Postoperative course was uneventful. It was necessary to replace the original spica

on May 27, due to a failure of the original plaster to set. The usual bifurcation after treatment was used. The spica was shortened to the knee at the end of the sixth week. The patient was discharged from the hospital, walking with crutches in a short plaster spica on July 7. There was no pain on weight bearing at this time. After final removal of the spica this patient disappeared from observation and received absolutely no after care. Approximately 9 months later she appeared in the dispensary of the hospital, walking without a cane or a crutch with a scarcely perceptible limp, and reported that she had been absolutely free from pain since her discharge. At the time of the last examination, approximately 18 months after operation, the patient showed an almost normal range of motion in the left hip, except for a limitation of rotation. There was a shortening of approximately three-fourths of an inch of the left lower extremity. The patient walked unusually well, and progression up and down stairs was consummated normally. This patient, it might be remarked, was extremely overweight, a condition which greatly added to the difficulties of carrying out the procedure.

CASE 4. Mrs. A. M., housewife, aged 54 years, was admitted to the Hospital for Joint Diseases on the service of Dr. Finkelstein on October 4, 1926, with the diagnosis of ununited fracture of the neck of the left femur. The patient sustained her injury 4 years prior to admission by falling on the ice. She received treatment at her home for 6 weeks, followed by 6 weeks of chiropractic treatment. A year later she entered a New York hospital, where an attempt was made to secure union by closed reduction and traction, without result. Upon admission there was a shortening of 1¾ inches of the left lower extremity with elevation of the left great trochanter. Motions of the left hip were restricted in all directions, particularly in reference to abduction. The patient walked with a decided left hip limp with use of crutches.

Upon admission to the hospital, the patient's physical condition was not good. An abdominal tumor mass was present in the right lumbar region. This mass was diagnosed as polycystic kidney. In spite of her physical condition a bifurcation was determined upon after a preliminary period of traction to reduce the shortening, and was performed with the assistance of Dr. I. S. Tunick, under nitrous oxide gas-oxygen-ether anæsthesia on November 4, 1926. The postoperative course was uneventful; no opiates or sedatives were necessary. The patient was permitted to bear weight in the full cast with crutches 3 weeks and 2 days after the operation. Six weeks after operation the spica was removed, and a short plaster spica extending to the knee was applied. The patient was discharged on December 22, 1926, approximately 7 weeks after operation, and massage and exercises were instituted. At the last examination, made approximately 1 year after discharge, she walked without a crutch or a cane, with a very slight tilt of the pelvis toward the left and with very little limp. Progression up and down stairs was normal. The thigh could be actively and passively flexed to 90 degrees. Rotation was limited. The actual measurable shortening of the left lower extremity was 1 inch. The patient has been free from pain since discharge from the hospital.

CASE 5. M. S., female, aged 3½ years, was referred to orthopedic service of Dr. Charles H. Jaeger at the Lenox Hill Hospital by Dr. Dewitt Stetten on March 11, 1927, with the diagnosis of pathological luxation of the left hip. The patient had been treated in the Lenox Hill Hospital for suppurative arthritis of the left hip from April 26, 1925, to September 13, 1925. The suppurative process involved the head and neck of the femur, and eventually caused absorption of the entire area with a formation of a "broomstick femur" and a shortening of the extremity amounting to seven-eighths of an inch. Subsequent to her discharge from the hospital after her initial illness, she was treated in the orthopedic dispensary of the hospital by means of a traction caliper brace in order to overcome the excessive shortening of the extremity. On March 29, 1927, with the assistance of Dr. Jaeger, a bifurcation was performed. The osteotomy was made at the level of the acetabulum which was empty, as there had been complete absorption of the head and neck. Postoperative convalescence was uneventful. On May 13, the child was discharged in a short plaster spica, in which she was permitted to walk. The plaster was totally removed at the end of the tenth week. When last seen, the child walked with a moderate left hip limp, which was well concealed by the clothing. There was a shortening of approximately three fourths of an inch. The X-ray films of this case show a tendency of the prong of the femur in the acetabulum to absorb. It is too early to consider this a final result in this particular case, although the present function is excellent.

CASE 6. Miss E. B., aged about 20 years; diagnosis tuberculosis of the right hip. This patient from the service of Dr. Leo Mayer, Hospital for Joint Diseases, began to limp 6 years ago. She was treated by orthopedic surgeons by means of a plaster-of-Paris spica for 6 weeks, by a long hip brace for 18 months, and after that a convalescent brace for 2 years. The brace was then left off altogether. Immediately prior to her first visit she had been in Florida, where she had been taking the sun cure. She felt well and had no pain in the hip but had some pain in the region of the knee. Her parents reported that she had limped quite markedly during the year prior to her first visit.

Examination revealed a well developed girl, looking husky and strong. There was no evidence of any general tuberculosis. The patient walked with a marked limp, due to instability of the right hip. Shortening of 1½ inches was present in the right hip, abduction was possible to 15 degrees, and there was diminished power in the abductor muscles. The X-ray picture showed marked absorption of the head of the femur with an upward excursion of the great trochanter, which was close to the pelvic wall.

There was considerable discussion in regard to this case. The Whitman reconstruction operation was recommended by a number of consultants, but a bifurcation operation was finally decided upon. This was performed on April 20, 1927, at the Hospital for Joint Diseases, by Dr. Leo Mayer assisted by the writer. An oblique osteotomy of the shaft was done after the upper end of the femur was exposed through a 6 inch incision. The osteotomy was performed obliquely beginning 3½ inches below the tip of the greater trochanter and extending upward and inward to a point just below the trochanter minor. The leg was abducted and the distal fragment dislocated, so that the apex of the cut surface rested against the inferior surface of the acetabulum. The extremity was put up in a plaster spica in 40 degrees abduction and 10 degrees of flexion. The patient had a short period of abdominal pain after the operation. She was permitted to be out of bed in the spica on May 14, and the spica was removed at the end of May. There was some swelling of the right leg at this time. The patient was able to abduct the right leg with only slight force. She walked quite nicely with the use of crutches. Following her discharge she made rapid progress, learning to walk with a very slight limp and without exhibiting the Trendelenburg sign.

On March 1, 1928, she walked practically without limp. The actual length of the left leg was 30 inches, of the right leg 27 inches. Despite this shortening, the apparent length of the extremities, owing to the pelvic tilt, was equal. The motions of the right hip showed flexion free to 90 degrees, extension to 180 degrees, abduction to 45 degrees, adduction

Fig. 4 (left). Case 2. Pre-operative roentgenogram. Destructive arthritis of hip after infantile epiphysitis. This hip exhibited no stability and should be classed as a pathological dislocation of the hip.

Fig. 5. Case 2. Postoperative in plaster. The outlines have been accentuated to demonstrate more clearly the two pronged fork of the bifurcation. Note that the upper end of the distal fragment enters the acetabulum. This is destined to serve as the weight-bearing head of the femur.

to the neutral position. There was about half of the normal rotation present.

CASE 7. Mrs. L. O., aged 49 years. This patient from the service of Dr. Leo Mayer developed tabes dorsalis 3 or 4 years previously. About 2½ months prior to admission, she felt a sudden pain and slipping in her right hip. She was treated with traction and a plaster-of-Paris spica, after which treatment she could walk fairly well, but had pain.

Examination showed marked crepitations within the right hip joint. The extremity was swollen throughout and externally rotated. The patient was unable to bear her weight upon the right leg. X-ray examination of the right hip showed a degenerative process within the joint with dislocation of the right hip and remnants of the head of the femur within the acetabulum. A diagnosis of Charcot hip was made.

Fig. 7. Case 2. The patient lying with the left thigh hyperflexed in order to fix the pelvis, is able fully to extend the bifurcated (right) thigh.

Fig. 8. Case 2. The patient lying with the left thigh hyperflexed in order to fix the pelvis is able to flex the bifurcated (right) thigh to approximately a right angle.

Fig. 6. Case 2. Approximately 3 years after operation. This X-ray indicates the end-result of the bifurcation. It will be noted that the pointed, weight bearing prong has been rounded off, so that it forms a serviceable head. The joint space of this neo-arthrosis is clearly visualized. This hip is stabile and mobile.

A bifurcation operation was done by Dr. Leo Mayer at the Hospital for Joint Diseases, on September 16, 1927. An oblique osteotomy of the femur was performed, the femur

Fig. 9. Case 2. Photograph of the patient standing and balancing upon the right extremity, which has been operated upon by bifurcation.

Fig. 10 (left). Case 4. Fracture of the neck of the left femur before operation. The outline of the trochanter has been retouched.

Fig. 11. Case 4. Retouched X-ray showing the end-result of a bifurcation performed for an ununited fracture of the neck of the femur. Note that the head lies between the two prongs of the fork. The sharp short prong is the weight bearing portion and the trochanteric fragment is the muscle lever.

being sectioned in a line running medially and upward into the lesser trochanter of the femur. The lower fragment was dislocated into the acetabulum and a plaster-of-Paris spica was applied with the hip in 40 degrees of abduction. The postoperative convalescence was uneventful. The plaster was removed below the knee on October 28, and the patient was able to walk with the assistance of one crutch. The condition continued to improve, and by January, 1928, she was walking without a crutch or a cane. On February 9, 1928, measurements revealed a 2 inch shortening of the right lower extremity. Active abduction was present to 35 degrees, active flexion to 25 degrees, and passive flexion almost to 90 degrees were present. With a compensation in the right shoe, she walked very nicely with only a slight limp.

Case 8. Mr. W. G., aged 52 years, was admitted to the Lenox Hill Hospital Dispensary, January 14, 1928, complaining of pain in the right hip and leg, which had made it impossible for him to work. The history dated back over 18 years, beginning with an attack of "sciatica," for which he was treated by various measures. The pain continued intermittently, and at times was so severe that he was unable to walk, and finally he was incapacitated completely. He was referred to the Dispensary of Dr. Walter Bopp.

Examination revealed a well developed, elderly, white haired man, who walked with a right hip limp, and with the aid of a cane. The right hip was extremely painful on motion; very marked muscle spasm was present. There was no ankylosis. X-ray pictures revealed an extreme osteo-arthritis of the right hip with some tendency toward subluxation.

The patient was operated on, January 17, 1928, on the service of Dr. Charles H. Jaeger at the Lenox Hill Hospital. Dr. Jaeger and the writer operated. The line of osteotomy extended obliquely into the lesser trochanter, and the displacement of the lower fragment was made at the point immediately below the rim of the acetabulum on the ischium. A spica was applied in 40 degrees of abduction, 10 degrees of flexion. The convalescence was uneventful and painless. The patient was permitted out of bed on February 13, on which date he stood upon the bifurcated extremity in the full spica. The spica was shortened to the knee on March 3, 1928, and totally removed on April 10, 1928. He was discharged on May 10, 1928, at which time he walked without pain, using a crutch as a cane. The right hip was carried in 20 degrees of abduction. Voluntary abduction was possible to 40 degrees, voluntary flexion to 110 degrees, and voluntary extension to 180 degrees. Rotation was almost totally restricted. Measurements from the anterior superior spine to the internal malleolus, were: right, 33½ inches; left, 34½ inches. The patient was last seen on June 18, 1928. Although he was able to walk without a cane he used one and walked without pain. Motions remained approximately as recorded above, except that slightly more adduction was possible.

Case 9. M. P., male, aged 55 years, was admitted to the Hospital for Joint Diseases, on the service of Dr. Harry Finkelstein, December 14, 1927, with the diagnosis of ununited fracture of the neck of the left femur. The patient fractured his left hip 6 months prior to admission and was treated in another institution in a plaster-of-Paris spica without result. The patient complained of severe pain in the left hip, completely incapacitating him. The patient upon admission was confined to bed by his disability, and was unable to rise without assistance. The left lower extremity was in external rotation. Voluntary motion of the hip was very much limited and painful. The passive motions were painful and restricted on this account. Sliding motion of the trochanter was present. Measurements of this case were through some error not recorded. On December 14, 1927, a bifurcation operation was performed upon the left hip. The usual spica was applied in 40 degrees of abduction, 10 degrees of flexion. The postoperative convalescence was uneventful. The spica was shortened to the knee on January 20, 1928. During the month of February the patient was permitted to walk with crutches in the shortened cast. The spica was completely removed on March 14, 1928, and, on March 23, he was discharged, walking on crutches, complaining of slight pain in the affected extremity. When last seen, in the follow-up clinic, in June, 1928, he was walking with the use of a cane and was still complaining of pain in the hip. About three fourths of an inch of measurable shortening was present. Motions of the hip were remarkably free and painless. Flexion was present to 90 degrees, abduction to 40 degrees; adduction was impossible and could be consummated only to 10 degrees of abduction. No sliding motion of the femur was detectable. It is too early to state the final result in this case. The outlook, however, is very favorable.

Case 10. S. S., male, aged 53 years, was admitted to the Hospital for Joint Diseases, service of Dr. Harry Finkelstein, on October 19, 1927, with the diagnosis of ununited fracture of the neck of the femur. Fourteen weeks prior to admission, he tripped and fell on the street, injuring his right hip. He was taken to a hospital, where he was treated and discharged, limping and having considerable pain. On

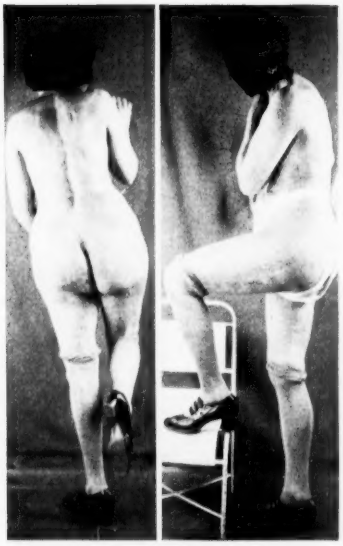

Fig. 12 (left). Case 4. The weight bearing function of the bifurcated hip is well shown in this illustration. The absence of the Trendelenburg sign is particularly noteworthy. Photographed 18 months after operation.

Fig. 13. Case 4. Active useful flexion of the bifurcated thigh. The scar of the operation is visible over the trochanteric area. Photographed 18 months after operation.

admission he presented the aspect of a somewhat aged man, who walked with a severe right hip limp. The motions of his hip were limited and painful. Flexion was possible through an arc of 40 degrees, abduction and rotation were strictly limited. One inch of shortening was present in the right lower extremity. The patient was first treated in an abduction internal rotation spica without result. On December 22, 1927, a bifurcation operation was performed by Dr. Harold Luskin. The osteotomy was performed below the lesser trochanter, and displacement was made against the inferior acetabular margin. The cast was shortened to the knee on February 16, after which the patient was able to walk with the aid of a crutch. The cast was removed on March 23, 1928, at which time the patient was able to walk without support. When last seen in June, 1928, the patient walked without crutch or cane, and without pain. The motions of the hip were painless and relatively free, considering the proximity of the operation. Flexion was possible through an arc of 90 degrees. The abducted position of the extremity was still fairly fixed. The patient is showing rapid improvement in all respects.

SUMMARY AND CONCLUSIONS

In conclusion, there are several points which might be reiterated. The bifurcation must not be regarded in any sense as a direct attempt to reconstruct the hip anatomically. The operation was primarily designed to relieve the pain resulting from a wide variety of conditions affecting the hip joint. It secures a functional and reasonably

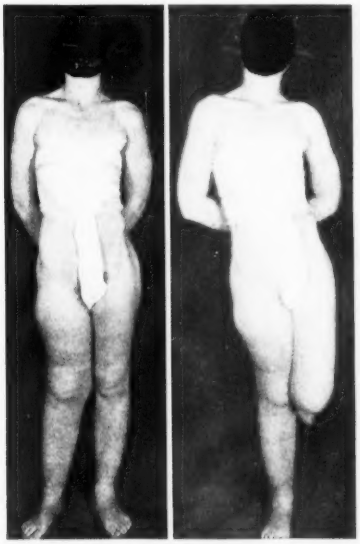

Fig. 14 (left). Case 6. End-result in a case of tuberculosis of the right hip, with great destruction of the articular area. The photograph was taken 11 months after operation. Note the pelvic tilt due to shortening and abduction of the extremity. When the patient is fully dressed, this is masked to a very great extent.

Fig. 15. Case 6. This photograph illustrates the absence of the Trendelenburg sign, when the patient stands upon the bifurcated extremity. This will perhaps give some idea of the stability and functional capacity of the new-formed articulation.

satisfactory cosmetic result, by the creation of an extra-articular neo-arthrosis. Anatomically, the new joint bears but little external resemblance to a normal hip joint. Architecturally and mechanically, the newly created articulation is sound and of sufficient strength to transmit the normal stresses falling through the hip. The operation, therefore, must not be condemned because upon first glance it is un-anatomical. Any critique of the procedure should be based upon a thorough comprehension of the mechanical and physiological principles involved.

A word of caution is not out of place. Although relatively simple in its details, the operator can easily go astray. It is absolutely necessary carefully to plan the line of osteotomy prior to the operation and accurately to osteotomize the femur in the calculated line. A variation of an inch or even less in the location of the section of the femur, or a variation of a few degrees in the direction of the section, may mean failure.

Even after the osteotomy it is necessary to exercise the utmost care in correctly displacing

and accurately maintaining the desired position of the thigh, until the plaster spica is completed. So important is this consideration that it is highly recommended that the operation should be performed in conjunction with a co-operator, who should be responsible for the proper displacement of the cut femur, while the operator firmly holds the osteotome blade in place after the bone has been completely divided. This small detail materially adds in securing a proper position. After displacement the proper holding of the fragments is of paramount importance, and can best be trusted to one thoroughly familiar with the principles of the operation. A failure in proper holding will lead to an unsatisfactory result.

It is important to remember that union between the shaft and the trochanteric fragment is essential to a satisfactory end-result. In personal communications from Lorenz and some of his co-workers, the writer has been informed that non-union has been observed in but one case of a total of 115 bifurcations performed in Vienna up to 1926. More recent figures from this clinic are not at present available. Several cases of non-union have been reported to me by some of my colleagues. The reason for failure of union lies most probably in a failure to maintain proper position and apposition during the application of the spica. I have also noted that some operators are inclined to shorten the spica too early. This permits external rotation of the lower fragment and loss of proper apposition. Dr. Harry Finkelstein has suggested the use of a nail to anchor the two fragments in place. The use of an osteoperiosteal graft may also be considered for this purpose. In the writer's experience these procedures have not been found to be essential, but may perhaps add to the security of position and the mental comfort of the operator.

The bifurcation is an operation still in its developmental period. Except in the Vienna clinic of Lorenz and his co-workers, the operation has been adopted very slowly. The results over a long period of years still remain to be determined, but from personal observation abroad and from fairly extensive use in this country, the writer would strongly urge an open-minded trial of what would appear to be one of the most valuable operative procedures for the re-establishment of the hip joint.

The writer wishes to express his thanks to Dr. Charles H. Jaeger of the Lenox Hill Hospital, to Dr. Leo Mayer, Dr. Harry Finkelstein, and Dr. Isidore Tunick of the Hospital for Joint Diseases, and to Professor Adolf Lorenz and his co-workers in Vienna, for their kind co-operation in forwarding this work.

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AN EXTENSION FRAME FOR THE REDUCTION OF FRACTURE OF THE VERTEBRAL BODY

WILLIAM A. ROGERS, M.D., F.A.C.S., Boston

THE urgent need of a simple, effective, and safe means of obtaining hyperextension of the spine became manifest in the course of a study of compression fracture of the vertebræ conducted during the past 3 years on the fracture service of the Massachusetts General Hospital. The apparatus described here has been devised to meet this need. Its use is recommended in this as well as in other conditions requiring spinal extension.

In the treatment of compression fracture of the vertebræ, correction of the deformity of the crushed body is necessary to assure restoration of function of the back.

Uncorrected, the wedge shaped vertebra throws the dorsal spine into the forward bent position. The effort to maintain the erect position enforces, in turn, a deep lumbar lordosis.

This exaggeration of spinal attitude, made necessary by the deformity of vertebræ, is possible only through the sustained action of muscles and ligaments. If the lordosis be extreme, muscles tire, and mild activities become laborious. Strain follows, causing backache, unless frequent rest is possible. The result from the economic standpoint is disability.

Analysis of the large number of poor end-results in these compression fractures discloses that the cause of disability is backache of muscle and ligament origin far more often than of pain at the site of fracture or pain referred along the corresponding peripheral nerve segments. Local pain at the site of fracture, and sometimes referred pain, may be eliminated by spinal fusion, but spinal fusion without correction of deformity may not be relied upon to relieve muscle strain, the commonest cause of disability in these cases.

Correction of the deformity of the vertebral body is accomplished by extension of the spine beyond the point at which the anterior ligaments and the discs come under tension. Until the spinal joints, above and below, are locked in complete hyperextension, correction of the vertebræ cannot take place, since forces employed up to that point are consumed in physiological extension. Beyond this point correction begins and should then be continued until the upper and lower surfaces of the involved vertebra are restored to normal relationship. Failure to correct deformity by extension is due to the fact that it is not carried beyond the limit of extensibility of the spinal joints above and below the fracture.

The accompanying roentgenograms show the correction obtained in three types of vertebral body injuries. In these and all cases treated on this service in the manner described herewith, either very slight and passing cord symptoms following the injury were found, or no cord symptoms whatever were shown.

Figure 1 shows the correction obtained by gradual hyperextension over a period of 10 days. In this case, one of fracture-dislocation of the first and second lumbar vertebræ, correction was brought about by means of the Bradford frame which was bent from day to day, the extension being increased until the physiological limit had been passed. This method is cumbersome and difficult to control in adults.

Figure 2 shows the correction obtained in a crush fracture of the second lumbar vertebra by the apparatus described here. Gradual extension was carried on over a period of 14 days.

Figure 3 shows the correction in a crush fracture of the twelfth dorsal vertebra by the same means, accomplished in 5 days.

DESCRIPTION OF APPARATUS

The apparatus is essentially a Bradford frame, excepting that spring steel bands, broad side horizontal, are used instead of pipe or tubing. The bands can be bent to render the frame concave or convex, but will not bend toward one another. The best quality (chrome vanadium) spring steel is advised, preferably 3/16 inch by 1¼ inch.

Canvas is stretched tightly across this frame and upon it the patient lies in the dorsal position. As the frame is rendered more and more convex, the spine is extended.

When such a frame is placed across a fixed yoke or cross bar and the ends are lowered, it gradually becomes more and more convex; just as the flexible board of a child's see-saw bends over the saw-horse when it is balanced with weight at each end.

The same effect is created by fixing the frame at each end and raising the cross bar or yoke by some form of jack.

Frame A (Figs. 4, 5, and 6) represents the extension frame attached to the bed. In this frame, the yoke is stationary and the ends of the

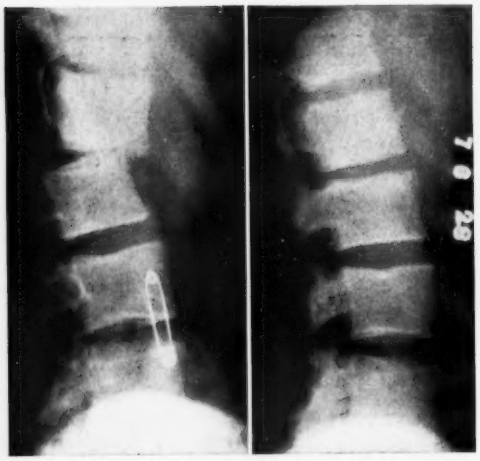

Fig. 1. Fracture dislocation first and second lumbar vertebræ (very slight and passing cord compression symptoms) before and after correction by hyperextension frame.

Fig. 2. Compression fracture second lumbar vertebra (no cord compression symptoms) before and after correction by hyperextension frame.

frame are raised or lowered through window cord and pulleys attached to the Balkan frame. This apparatus is the most generally adaptable form since it may be adjusted to the usual hospital beds, is portable, and is cheap.

The yoke is clamped to the bed at a point opposite the lesion. The frame, previously covered with canvas, is clamped to the yoke. In this form the yoke is 24 inches above the bed. The frame is about 74 inches long and 24 inches wide.

The heaviest canvas or duck should be used to prevent sagging, which will hinder accuracy of control. The canvas or duck can be stretched tightly across the frame by the use of leather cinch straps, rings, and buckles, placed about 1½ inches apart, opposite the spine, and 6 inches apart below the buttocks. A separate canvas band about 6 inches wide is placed opposite the buttocks for convenience in nursing, and obviates shifting the patient. Made as described, the cost is about thirty-five dollars, and the work can be done by any good mechanic.

Fig. 3. Compression fracture, twelfth dorsal vertebra (no cord compression symptoms) before and after correction by hyperextension frame.

Frame B (Fig. 7) represents the extension frame fixed at its ends to the hospital bed, and rendered concave or convex by raising or lowering the yoke by means of jacks.

Slotted bars, one at each end, are suspended from the end rungs of the bed. Through the slots the spring steel side bands of the frame are passed. The yoke is operated by pinion wheels, meshing with the pinion uprights which are attached to the yoke at either end. The pinion wheels are operated by a common shaft turned with a crank handle, as illustrated. The mechanism is locked by a ratchet and pawl. In order to obviate accidental release of the pawl, a wing screw is attached directly above it. The yoke and jacks may be placed at any desired level of the spine and there fixed to the sides of the bed. This apparatus is very simple to operate. The cost is about twice that of Frame A, and it must be made up to fit the type of bed used.

Frame C (Figs. 8, 9, and 10) represents the extension frame attached to a steel tubing carriage as a separate unit. An additional pair of jacks,

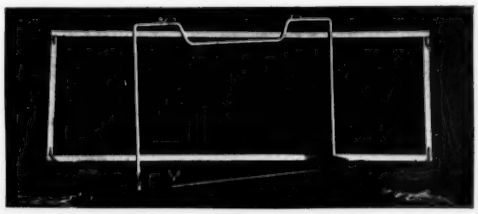

Fig. 4. Frame A. Group of parts showing flexible frame of spring steel bands with window cord attached; stationary yoke, adjustable to fit various beds; pulleys through which window cord passes for varying the convexity of the frame. Note clamps at top of yoke to fix to it the flexible frame.

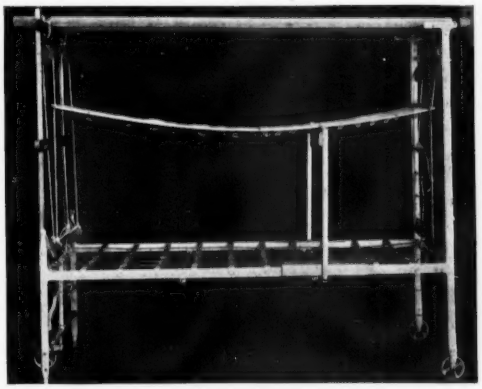

Fig. 5. Frame A. Extension frame, covered with canvas, attached to bed. The ends are elevated to render it concave. The pulleys are fastened to a Balkan frame.

although not necessary, may be placed at the head end to raise this end as the convexity is increased. It obviates a feature disagreeable to some patients of having their heads lower than their bodies. Provision is made for traction should circumstances require its use. This frame costs about twice as much as Frame B.

MECHANISM

The correcting force, operating through the agency of this frame, is that of gravity. It is diffused along the entire length of the vertebral column, is very great, and is completely under control. Each spinal segment falls into proper alignment without strain. There is no force concentration at any one point, so that any possible risk is obviated. At the same time, the patient is conscious of no other restraint or discomfort than having to lie on the back, provided the extension be accomplished gradually.

TREATMENT

Treatment should be started with the frame concave, and during the first several days extension should be slow. Thereafter, the rate may be increased, and usually after the third or fourth day can go forward rapidly. Full correction is obtained in 5 to 10 days as a rule.

A feeling of tension on the abdominal muscles experienced by the patient heralds the approach of the limit of extensibility of the spine. Hyper-

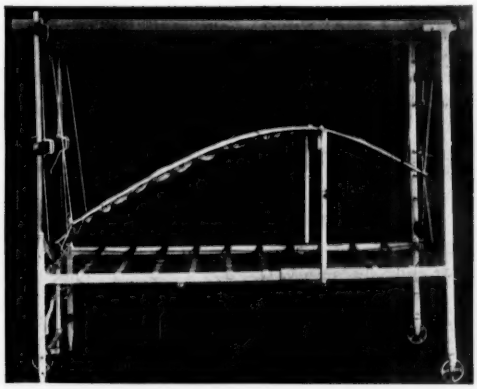

Fig. 6. Frame A. Same as Figure 5 except that the ends have been gradually lowered rendering the frame convex. The spine is extended in this way. This is the simplest, cheapest form of extension frame described here. It fits the usual hospital bed, and is easily made.

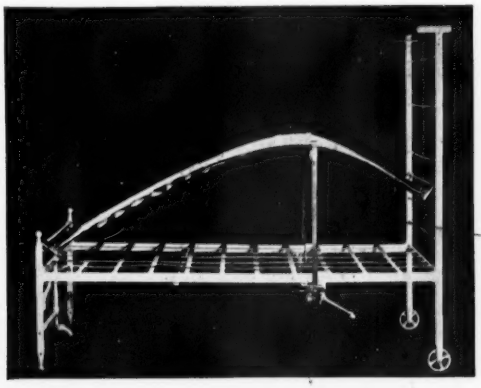

Fig. 7. Frame B. The flexible frame, fixed at its ends to the bed, is operated by raising or lowering the yoke with jacks. This apparatus must be made to fit the type of bed to be used. More convenient and accurate than Frame A, but about three times as expensive.

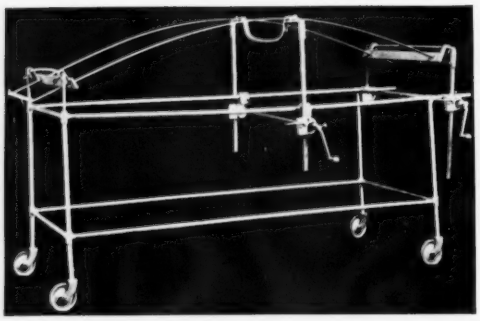

Fig. 8. Frame C. Separate unit. The flexible frame is attached at its ends to a steel tubing carriage and is operated by jacks as in Frame B. The head end may be raised or lowered by the extra pair of jacks. Traction may be used. Very accurate, adjustable, and convenient. Costs about twice as much to make as Frame B.

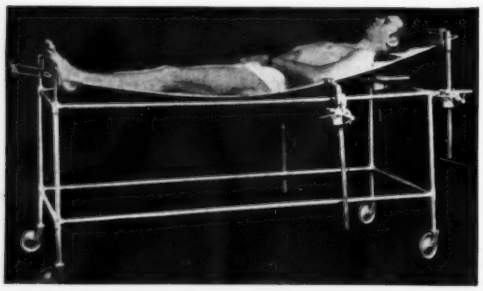

Fig. 9. Frame C. Frame in operation. Spine in slight flexion.

extension is continued until the flatness of the dorsal spine, the flare of the ribs, and the absence of abnormal prominence of the spine of the involved vertebra point to correction. At this point lateral roentgenograms have invariably shown the desired correction. Should correction not be complete, extension should then be resumed until roentgen evidence of restoration of the vertebral contour has been obtained.

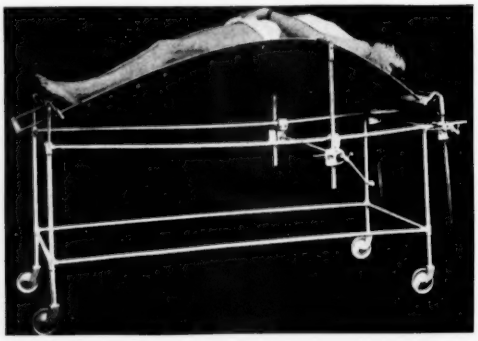

Fig. 10. Frame C. Frame in operation. Spine approaching limit of hyperextension.

The apparatus may be operated safely and according to a prescribed schedule by the usual hospital attendant.

In securing confirmatory roentgenograms the patient is shifted to a Bradford frame, narrower than hips and shoulders, and bent to the same degree of extension. To this the patient is fixed with swathes and may then be turned on the side for lateral views on the Buckey diaphragm.

Correction having been obtained, the patient may be placed on a Bradford frame, or provided with plaster shells for a period of 8 weeks. A plaster jacket should then be applied in extreme hyperextension, preferably by the aid of Goldthwaite irons, and the ambulatory phase of treatment begun. It has been our custom to secure roentgenograms of these patients through windows cut in the sides of the plaster jacket opposite the involved vertebra. Excellent lateral views may be obtained in this way. By doing this before, and one week after, starting the ambulatory phase, a check on the efficiency of the jacket is obtained.

RUPTURED URETHRA OPERATION[1]

GEORGE G. DAVIS, M.D., F.A.C.S., CHICAGO

THE writer wishes to present a method of introducing a catheter from the bladder through the penis in cases of rupture of the urethra. Two sounds are employed which we may designate *A* male and *B* female. Sound *A* is an ordinary sound with a hole drilled through it about one-half inch from its tip. Sound *B* (female) is cupped on the tip to receive sound *A* after a suprapubic cystotomy has been performed. Sound *A* (male) is introduced through the meatus of the penis; sound *B* (female) is introduced into the urethra from the bladder. The tips of the sounds in the urethra are then clicked, and the male sound is engaged in the cupped end of the female, *B*, sound and then the male sound enters the bladder, being guided by the female sound. A silk or catgut suture is passed through the drilled hole of the male sound in the bladder, and a rubber catheter is connected to the suture. The sutures are tied and the catheter is introduced from the bladder through the penis and left in place. The cystostomy, of course, is continued for a number of days for drainage.

Fig. 1. Hole is shown in tip of male sound, *A*, through which, when introduced into bladder, a suture is passed. To the suture, the tip of a catheter is tied and then brought from bladder through the urethra. This male sound, *A*, is introduced via meatus of penis. The female cupped sound, *B*, is introduced into urethra via bladder and guides male sound into bladder, after the ends of *A* and *B* have engaged, as shown in the small diagram.

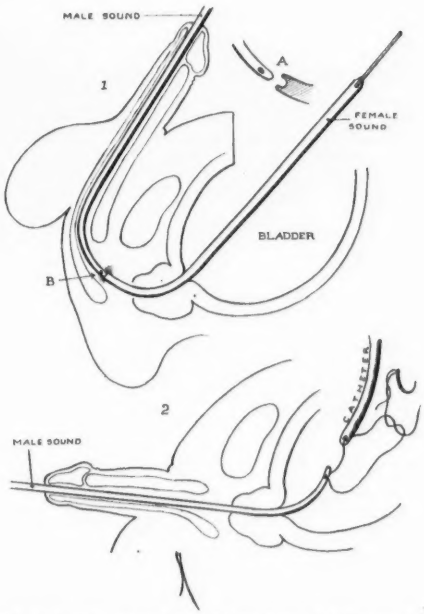

Fig. 2. *1*, Shows male sound introduced via meatus of the penis to site of rupture of the urethra, *B*, and engaged in the cupped end of the female sound introduced via bladder. *A* demonstrates the cupped end of female sound and tip of male sound with a hole in it. *2*, Male sound with a suture through hole at tip is ready to pull the catheter from bladder through penis.

The great advantage of this operation is that it does away with the perineal incision which, undoubtedly, in many cases causes subsequent strictures. It is a simple method, easily performed, and the end-results are gratifying.

On April 20, 1929, the writer used this technique on a patient, A. K., Register No. 2850, I. S. Co. Hospital, Gary, Indiana. The patient had had a severe squeeze between the couplings of railroad cars. A catheter could not be introduced. This technique was employed. The patient made an uneventful recovery.

[1] Read before the Lake County Medical Society, Hammond, Indiana, June 13, 1929.

STONES IN THE URETER[1]

HERMON C. BUMPUS, JR., M.D., F.A.C.S., ROCHESTER, MINNESOTA
Section on Urology, The Mayo Clinic
AND
GERSHOM J. THOMPSON, M.D., ROCHESTER, MINNESOTA
Fellow in Urology, The Mayo Foundation

FROM January 1, 1919, to January 1, 1928, the diagnosis of stone in the ureter was made in 1,001 cases. The results of a clinical study of these cases are recorded herewith.

SYMPTOMS

Pain originating in the renal area and radiating toward the bladder was noted in 634 cases (63.4 per cent), but only exceptionally did it radiate to the inner side of the thigh or to the genitals. In 37 cases the radiation was reversed; it occurred from the bladder toward the kidney; in these cases the stone was discovered in the lower part of the ureter. Pain in the lower right quadrant without radiation and with little suggestion of renal colic occurred in 138 cases; in such cases the appendix often is removed without relief of symptoms. It was removed in 37 cases in the group of 138, an incidence of 26.8 per cent.

Appendectomy had been performed in 226 of the 1,001 cases; many of the operations without question were indicated but an average of more than 1 in 5 cases of stone in the ureter in which the appendix is absent is probably greater than in any other disease, and the physician must be careful to exclude the possibility of stone if symptoms persist after appendectomy. As further evidence that these figures are not extreme is Cabot's report of 153 cases of stones in the ureter, in 30 of which appendectomy had been performed.

In 162 cases the pain had been entirely epigastric and cholecystitis had been diagnosed. In 17 cases a diagnosis of peptic ulcer had been made elsewhere, and a fluoroscopic examination of the stomach at the clinic proved negative in all but 1 case. Search was made for some other explanation of the epigastric distress and ureteral calculi were discovered, the removal of which relieved the symptoms in every case. This frequency of reflex gastric complaint was manifested in 304 cases in which nausea and vomiting occurred during attacks.

During attacks almost half of the patients (456) noted marked frequency, and 254 did not have urinary disturbances. Many of the patients gave a history of frequency and slight dysuria associated with vague indefinite abdominal pain without a history of colic. This led to the investigation of the urinary tract that resulted in the finding of the calculus in the ureter. The association of vague abdominal pain with urinary frequency would, therefore, seem to be a sufficient indication for a careful roentgen-ray examination of the urinary tract.

Hæmaturia discernible to the patient occurred in 300 cases and was reported by an attending physician as appearing microscopically in 57 cases. From the standpoint of the patient the most alarming symptom was anuria. This occurred in 27 cases; in 22 it was evidently reflex in type, since obstruction was not demonstrable in the opposite ureter. The reflex anuria did not last more than 24 hours in any case, so that anuria of longer duration is probably due to obstruction.

The 5 remaining cases of the series are summarized. They are of interest in showing how rapidly the urea values of the blood will return to normal as soon as obstruction to urine is removed.

CASE 1. A man aged 56 years had had anuria for 7 days. The left kidney was functionless and a stone was present in the right ureter. The blood urea was 172 milligrams for each 100 cubic centimeters. Obstruction in the right ureter was passed by a catheter, and the blood urea was normal in 5 days. Surgical procedures were advised but the relatives refused operation and took the patient home, where anuria again developed, and he died in 3 days.

CASE 2. A man aged 45 years had had anuria for 36 hours. Right nephrectomy had been performed 9 years previously. Stone in the lower part of the left ureter was passed by a catheter, and later was removed by manipulation. The patient is now well.

CASE 3. A woman aged 73 years had had anuria for 8 days. Right nephrectomy had been performed 12 years previously. A stone was found in the upper part of the left ureter at the ureteropelvic juncture. The blood urea was 214 milligrams for each 100 cubic centimeters. A catheter was passed by the obstruction for drainage. The blood urea became normal within 6 days. The stone was removed surgically, with recovery of the patient.

CASE 4. A woman aged 53 years had had anuria 60 hours. Right nephrectomy had been performed 9 years previously. A stone was found in the middle third of the left ureter. The blood urea was 220 milligrams for each 100 cubic centimeters. A catheter passed the obstruction, and after 8 days of catheter drainage the blood urea became normal. The stone was manipulated. Patient recovered.

CASE 5. A woman aged 35 years had had anuria 57 hours. Right nephrectomy had been performed 4 years previously. A stone was found in the lower part of the left ureter. The blood urea was 438 milligrams for each 100

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cubic centimeters. A ureteral catheter could not pass the obstruction. Pelviotomy and decapsulation were performed. The patient died a short time after the operation.

The formation of urinary calculi has been attributed to whatever phase of scientific endeavor was at the time popular. In the days of the alchemist, and later, stones were explained on the basis of chemical changes alone. Even today patients are frequently advised to drink only distilled water, it being assumed that processes involved in the formation of renal stones are similar to those involved in the deposition of lime salts on the interior of a hot water boiler. Since distilled water is not readily available, such patients usually drink less than a normal amount of water, so that the urine becomes concentrated and the deposition of urinary salts is enhanced.

Ebstein and Nicolaier, in 1891, for the first time produced stones in the urinary tract of animals by feeding oxamid, a derivative of oxalic acid. Keyser repeated their experiments successfully at The Mayo Clinic but in spite of these promising experiments no one has ever been able to produce urinary calculi experimentally in animals by feeding in excess any of the normal constituents of the animal's food.

Following the work of Pasteur, micro-organisms were naturally considered the causative agent of stones. Rosenow and Meisser have reported the formation of stones in the dog's kidney following the production of an artificial focus of infection in a tooth. The part played by focal infection as the cause of renal and ureteral lithiasis is not as yet proved, but Rosenow and Meisser's work strongly indicates it as a factor. In the years 1925, 1926, and 1927, of all the patients with ureteral stones who had special examination of their teeth and tonsils, 82 per cent were found to have definite infection in the tonsillar crypts, in the roots of teeth, or in both. The distribution was as follows: infected teeth and tonsils, 34 per cent; infected teeth only, 16 per cent; infected tonsils only, 32 per cent; neither teeth nor tonsils, 18 per cent.

During the last decade the popularity of the diagnosis of stricture of the ureter in explanation for all symptoms led its originator to include the formation of urinary calculi among the ills for which stricture is responsible. In view of the fact that strictures of the ureter are more common in females than in males, because of the incidence of pelvic infection to which the former is subjected, it is worthy of note that 70 per cent of the patients in this series were males. A further observation that would seem to discredit the part played by the stricture as an etiological factor is the incidence of recurrence in this series. In 32 cases the stone recurred in the same ureter and in 30 in the opposite ureter.

More recently, as might be expected, vitamin deficiency is being considered as the cause of urinary calculi. This series of cases does not present evidence either for or against this hypothesis.

ROENTGENOLOGICAL DATA

The percentage of stones that will not cast a shadow has been variously estimated. Besides the cystine and pure uric acid stones, which fortunately are rare, the recently formed stone, because of its lack of density, is the most difficult to demonstrate roentgenographically and the one therefore most frequently missed. In this series a stone could not be demonstrated roentgenographically in 21 cases (2.1 per cent). This low percentage of negative results is undoubtedly due to the reading of the plates by the urologist, who has available at the time all the cystoscopic and other data on the case. The roentgenologist, without such aid, cannot be expected to make a definite diagnosis of stone in such a high percentage of cases, for many of the shadows are indistinguishable from phleboliths except for the additional information furnished by the cystoscopic data.

CYSTOSCOPIC DATA

Seemingly it would appear that the incidence of a ureteral stone causing obstruction to the passage of the ureteral catheter is high, for the ureter is not large and a small stone would seem sufficient to obstruct a catheter, yet all urologists recall how frequently even large stones fail to obstruct the passage of catheters. In this series, there was definite obstruction in 554 cases. In many cases this was passed easily with a catheter, usually with little, if any, obstruction to the passage of urine.

Grating on the ureteral catheter with transmission of the vibration to the finger tips of the operator was noted in only 192 (19.2 per cent) of the cases and hence cannot be regarded as a particularly valuable test, as absence of the vibration is of no particular significance. The wax tip catheter was used in a few cases and was considered of value only as confirming data.

Inclusion of the shadow of stone by the urographic medium was the chief aid to diagnosis and was the only observation besides the shadow of the stone in 223 cases.

TREATMENT

Since Lewis, in 1904, first introduced his instruments for the manipulation of ureteral stones, many urologists have persistently endeavored to remove as many ureteral stones as possible by

cystoscopic means. Such endeavor was accelerated markedly in 1921 by a paper by Crowell in which he reported removing stones from the ureter by cystoscopic means in 88 cases in a series of 95. He depended largely on the slow dilatation of the ureter by the placing of increasingly large catheters and leaving them for a day or two, and he believed that the consuming of several months' time in his endeavors was not contra-indicated if he was finally successful in removing the stone without resorting to operation. Of course, to most urologists such delay would be a strong contra-indication to the method, and as Judd had recently reported 400 operations of ureterolithotomy with but a single death attributable to the operation, the more rapid surgical method would still have a strong appeal. In the discussion of Crowell's paper, Braasch pointed out that the method seems particularly applicable to small stones of recent origin, and that severe reaction or acute pyelonephritis attending or immediately following manipulation must be guarded against.

Stimulated by Crowell's report, many physicians undertook to remove more stones by manipulation, and individual apparatus for hastening removal of the stone either by dilating the ureter or crushing the stone, or if the stone was not too large, by bringing it out intact, were rapidly developed and presented to the profession. The best known of these instruments was Stirling's ureteral forceps. The Vose stone extractor, the Dourmashkin bag, the Smith spiral filiform tip catheter, the Walther bougie with filiform guide, the Buerger olives, and the Livermore stone manipulator all proved successful in some cases but the more rapid removal of stones by these methods was bound to produce much more trauma to the ureter than the slower method of manipulation by catheter, and there soon appeared in the literature reports of untoward results not usually occurring when the more leisurely methods were in vogue. Folsom said: "I want to call attention to the danger of the procedure. Cases under my observation that vividly impressed me on the day following the effort to dislodge the stone had acute suppurative nephritis. That situation can occur rather more frequently than we think. The question of a severe infection spreading rapidly following these manipulations has to be taken into consideration." Bugbee wrote: "While all of the modern intra-ureteral instruments for the purpose of dilating and cutting the ureter, or grasping the calculus have been used and are still occasionally employed we have had better results as regards ultimate passing of the stone, less pain and traumatism incident to manipulation and an absence of infections following the simple shifting of the axis of the calculus or traction on the calculus by the use of soft ureteral bougies or catheters wedged in between the calculus and ureteral wall or coiled about the calculus." Beer and Beer and Hahn also advocate the method of simply passing a catheter by the stone and allowing it to remain for from 2 to 5 days. Beer said: "The mechanism is not clear. Perhaps the œdema of the mucous membrane which holds the stone is allowed to subside, perhaps some traction on and dislocation of the stone are caused by withdrawal of the catheter, or perhaps dilatation of the ureter is the chief factor. Whatever the mechanism is it has two great advantages over other methods in this category: (1) a single treatment frequently suffices to deliver the stone, and (2) stones are passed with very little pain." Beer was successful in 60 per cent of his cases by this simple method.

The experience gained in this series has led us to agree fully with the foregoing quoted data. Thus we find that in 146 cases the stone passed following the manipulation incident to the first cystoscopic examination, whereas in 274 other cases manipulation was followed by success in 202; in 65 of these, ureteral meatotomy was done as an aid to manipulation with scissors designed by one of us (Bumpus) for the purpose, or with fulguration. In 63 cases surgical removal was necessary after manipulation had failed. Eleven patients refused surgical treatment after failure of manipulation. Hunner early pointed out the danger of such delay. He said: "In the use of intra-ureteral manipulations every precaution should be used to safeguard the patient and one should be ready to operate on the first sign of renal damage or indication of exhaustion from pain." Two of these patients, after the lapse of 5 to 7 days had rendered their condition critical, consented to operation. Both died from sepsis. Since then we have always secured permission to resort to operation if the manipulation failed.

In 74 per cent of the cases in which manipulation was attempted, the stone was removed. This percentage does not include the 146 cases in which stones were passed after a single cystoscopic manipulation. Were these cases included, the total in which manipulation was successful would be raised to 85 per cent of the cases in which it was attempted.

There were 252 cases in which stone was removed surgically from the lower third of the ureter and 228 such cases involving the upper and middle thirds. In 49 cases the urinary obstruction produced by stone in the lower part of the ureter had resulted in such extreme ureteral and renal

injury that nephrectomy or nephro-ureterectomy was required. If these 49 are excluded, we find that 60.7 per cent of all the stones in the lower part of the ureter were removed by manipulation. We believe this is a conservative estimate as to the number of cases in which it is feasible to remove stone by manipulation, and we believe further that if an attempt is made to remove stone by manipulation in a greater number of cases, the procedure will not only fail but the incidence of suppurative pyelonephritis with multiple cortical abscesses and the mortality rate will increase. In this series such reactions occurred 32 times (11 per cent) in the 274 manipulations, including the 2 fatal cases referred to.

Efforts to deliver stones by cystoscopic manipulation should not be carried to a point at which there is grave danger of suppurative pyelonephritis. Cases which show marked infection should, we believe, be treated by ureterolithotomy rather than by manipulation, as should cases with stones which are of more than 1.5 to 2 centimeters in diameter and which are known to have been present for a considerable period.

Reaction following manipulation can be reduced to the minimum if ureteral catheters are left in the ureter to insure drainage following the removal of the stone, for the œdema produced by the manipulation, together with the resulting ureteritis and peri-ureteritis, if adequate drainage is not insured, results in rapid ascending infection. When this has occurred, any delay in operating to relieve the stasis and infection greatly increases the risk. In all the cases in this series in which operation was performed as soon as signs of renal infection appeared, the patients recovered. The two deaths referred to give a mortality in the series of 0.2 per cent following catheter manipulation. There were 9 deaths following the surgical treatment of ureteral stones. The majority of these cases were complicated by the presence of renal stones and poor renal function, and the operation was done as a life-saving measure. The mortality in the entire series of 1,001 cases was 1.1 per cent.

The operations performed in the 529 cases were: ureterolithotomy, 372; nephro-ureterectomy, 51; nephrectomy, 37; ureterectomy (nephrectomy elsewhere), 3; and combined operations, 66.

RECURRENCES

At The Mayo Clinic roentgenograms are made in all cases following either the surgical removal or manipulation of urinary calculi in order to make sure that, if fragments are left or only a portion of multiple stones removed, the cases may not, in the future, be classified as recurrences. In many cases, of course, stones continue to form for years. In several cases in this series there was a history of many stones having passed 25 to 40 years before there was one too large to pass. Sixty-two (6 per cent) of the patients in the series are known to have had recurrence, 32 in the same ureter and 30 in the opposite ureter.

The benefit from the removal of the stone was usually immediate and permanent, as infection rarely persists after stones are removed.

No attempt was made, except in individual cases, to dilate the ureter for a certain period as a prophylactic measure. The possible benefit in a few cases did not seem to justify treatment in all cases. The importance of removing all foci of infection was strongly emphasized, and they were removed whenever possible before patients were dismissed from observation.

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RADIUM THERAPY IN THE TREATMENT OF CANCER OF THE VULVA

IVAN DE BÜBEN, M.D., BUDAPEST, HUNGARY
Clinical Assistant, I Gynecological Clinic of the Royal Pázmány Péter University, Budapest

CANCER of the vulva is one of the most difficult types of cancer to treat. Both operation and the use of radiotherapy so far have failed to yield the results hoped for. As far as end-results are concerned, in the treatment of cancer of the vulva as in the treatment of cancer in general, the majority of surgeons consider that the most suitable procedure is operation and then the use of radiotherapy. Recently the value of radium in the treatment of cancer of the vulva has been more and more stressed as reports have been published describing the good results obtained from its use.

During the last 10 years (1918–1928) in the I Gynecological Clinic we have treated with radium and high voltage therapy 31 cases of cancer of the vulva. This is a goodly number, as cancer of the vulva is not as common as cancer in other regions; therefore, the correct supervision and follow-up of these cases has enabled me to learn much regarding the value of radiotherapy in the treatment of cancer of the vulva.

Cancer of the vulva constitutes 3 per cent of the cancers of the female genitalia; it is scarcely more frequent than the rarely occurring primary cancer of the vagina. Usually we find it in older women long past the climacteric. In our series most of the patients were beyond the age of 60 years. At less than 40 years of age cancer of the vulva seldom appears, although we have treated four patients who were younger, one being 22 years old. Our oldest patient was 77 years; the youngest 22 years old. This fact indicates a wide range as to age incidence. Of female genital cancers, cancer of the vulva occurs usually at an advanced age; often the patients are between 60 and 70 years.

We have observed the growth on all parts of the external genitalia; usually it is found on the labia majora and minora, at the site of the clitoris or the urethral orifice. Usually it originates in the epithelium of the vulva and seldom develops from the Bartholinian and sweat glands. In our series the cancerous tumor was situated in 9 cases on the labium majus; in 6 cases on the labium minus; in 7 cases on both; in 5 cases at the site of the clitoris; in 4 cases near the urethral orifice. Only once was it seen at the level of the Bartholinian gland. In this case the histological examination showed an adenocarcinoma.

Cancer of the vulva is usually primary; it may be secondary to a cancerous growth of the surrounding organs. Metastasis generally occurs through inoculation in incisional scars made in vaginal total extirpations. The etiology of vulva cancer—like that of other cancerous growths—is unknown. We cannot correlate its frequency with the number of births and abortions, as in our material as in that from other clinics, 50 per cent of the patients were nulliparæ or primiparæ and secundiparæ. We might rather consider kraurosis as a favorable soil for cancer; many regard this disease of the vulva as a precancerous state.

Microscopically cancer of the vulva is generally a squamous cell epithelioma, rather exceptionally it may be an adenocarcinoma. In almost all of our cases the histological diagnosis was squamous cell epithelioma. It starts in the form of nodules of different sizes, which slough and soon necrotic ulcers with everted borders are formed. When ulceration sets in, the cancerous nodules proliferate quickly and form tumors of various sizes, which often occupy the whole vulva. Because of the abundant lymphatic communications of the vulva, cancer in this region is one of the most malignant types; cancer of the clitoris is especially malignant. The inguinal lymph glands soon become infiltrated and form smaller or larger tumors; later on in a more advanced stage the pelvic lymph glands become involved. Besides the lymph vessels the adjoining organs will be endangered and the cancer may invade the vagina, urethra, bladder, and rectum; it may involve the connective tissue and bones of the pelvis. Metastases to distant organs seldom occur.

In the beginning cancer of the vulva does not cause remarkable disturbances. Hence many patients consult a physician only when the disease has reached an advanced stage and pains and difficulty in urination are present. The development and extension of vulvar cancer may vary. In general the course is slower in patients of more advanced age than in young patients in whom a rapid decline is sometimes observed. According to the experiences of Berecz and Lewres, pregnancy stimulates the development and extension of vulvar cancer. Death generally occurs as a result of cachexia or sepsis, but is often caused by infections of the urinary tract.

In the advanced stage the diagnosis of vulvar cancer is easy; in the incipient stage differentiation from sarcoma is difficult, as their clinical appearance is very similar. To diagnose vulvar cancer, excision and histological examination are necessary.

In the treatment of cancer of the vulva operation and radiotherapy are the only methods which should be considered. Radical removal of the vulva with the simultaneous extirpation of the inguinal lymph glands is advisable. Stoeckel is not satisfied with this; he believes that the pelvic glands also should be removed. Such an extensive operation can be performed only if the patient is in a good condition. If the growth has reached an advanced stage and the patient is in poor condition, radical operation is out of the question. We must then content ourselves with the operative removal of the local tumor and the treatment of lymph glands with radiotherapy. Since the study of the end-results after operation shows frequent recurrences, operation alone cannot be said always to be productive of permanent cures. For this reason the adherents of operation have come to recommend the use of radiotherapy together with operation.

At first radium as a means of treating cancer of the vulva offered great hopes, but it was soon found that the improvement from such treatment was only temporary in many cases and that the percentage of permanent cures was but slightly increased.

Radiotherapy may be used even in patients belonging to that larger group—those of advanced age with extensive growths—and although permanent cure is rather exceptional, temporary improvement can generally be obtained, so that radiotherapy plays a most important rôle in the treatment of cancer of the vulva.

We generally use a high voltage current in combination with radium therapy. For local treatment radium is usually used, and lymph glands are irradiated with roentgen-rays.

Radium irradiation of cancer of the vulva can be accomplished in many ways. The implantation method is widely used and is very satisfactory. Radium may be implanted with needles, emanation tubes, small radium tubes, and thorium-X rods. Platinum needles 0.3 to 0.5 millimeters thick, each of which contains 1 to 2 milligrams of radium, or condensed emanation are used. They are placed 1 to 2 centimeters apart and a sufficient number is used to cover the neoplasm. Small tubes each containing 2 milligrams of radium and fitted with a 1 millimeter platinum filter are embedded, 2 centimeters apart, in the tissues by means of a special trocar. With threads attached to them these tubes can be easily withdrawn at the desired time. Local anæsthesia is used.

Institutions which have large amounts of radium have recently made use of tele-irradiation in the treatment of malignant neoplasms, such as cancer of the vulva. Quantities of radium, which may amount to several grams, are placed in metal box containers of various shapes and sizes and generally lined with lead. These metal box containers are placed in cases which are attached to a stage that is movable in all directions and may be fixed at any desired distance from the skin. This arrangement is similar to that used in deep X-ray therapy. With it malignant tumors at very different sites can be given homogenous X-ray irradiation in several fields. Tele-irradiation should not be used in private practice but should be confined to institutions which handle large amounts of radium.

In the radium treatment of vulvar cancer, columbia plates can also be used to fix the radium tubes in the proper place and at the proper distance. The widely used columbia plate, which is recommended by the Paris Radium Institute, is made by melting a mixture of beeswax, paraffin, and sawdust, and can be molded in water at a temperature of 45 degrees. We ourselves can, therefore, easily make radium holders suited for any special purpose. The deeper the malignant tumor, the greater must be the skin distance.

The desired skin distance is maintained either by increasing the thickness of the plate or, still better, by melting small wax brick radium holders into the plate. The thickness of the plate usually varies between 1 and 3 centimeters. By means of a warmed instrument, filter fitted radium tubes can easily be embedded in the wax plate in the required number and at the proper distance.

On several occasions we have found the columbia plate very useful in applying radium to cancer of the vulva, in that it fixes the radium tubes in suitable position and at the proper distance. So for a patient who had a very advanced growth which was the size of a large plum and involved both labia minora, I molded a columbia plate with a tongue-shaped flap which reached the tumor and with a base which could be attached to the symphysis. In the upper part of the flap an opening was made for the insertion of a permanent catheter. On both sides at the level of the cancerous tumor, I inserted silver and brass filter fitted radium tubes which contained together 50 milligrams of radium. Between the labia, with tubes melted into a wax wedge which projected from the lower surface of the flap, I applied another 50

milligrams of radium. In all a dosage of 4,800 milligram element hours was given. On the fourteenth day after treatment, the cancerous tumor had diminished to one-tenth of its former size; 33 days after treatment it had almost entirely disappeared. We irradiated the lymph glands by means of the roentgen-rays. In several instances this method proved to be successful.

Radium gives somewhat more encouraging results in the treatment of vulvar cancer than in the treatment of vaginal cancer. As cancer of the vulva is rare there are not sufficient data on which to base definite opinions as to the value of radiotherapy. Therefore, we must base our conclusions on the few reports in the medical literature.

Of 31 patients with carcinoma treated with radium at our clinic during the period 1918–1928, 2 were free from recurrence 6 years later. One lived 4 years after radiotherapy, 2 lived 3 years, 3 lived 2 years, 5 lived 1 year, 7 died within 1 year, and in 7 the duration of life is unknown. Besides 2 free from recurrence 6 years after treatment, 4 other patients are under observation.

After excision and microscopical diagnosis, patients with cancer of the vulva to be treated with radiotherapy are given a single radium ray dose amounting to 1,200 to 2,400 milligram element hours, if possible. Then if at control examination the effect seems to be unsatisfactory, the radium treatment is repeated in 6 to 8 weeks. For irradiation of the lymph glands we use roentgen-rays; a pigmentation dose is applied three times at intervals of 6 weeks. Patients treated with radiotherapy are instructed at the end of treatment to return for examination every 3 months, later every 6 months. Those who do not come back are followed up by letter.

Our results compare favorably with those reported in the literature, especially when we consider that in the majority of our patients the growth had reached an advanced stage.

At the II Gynecological Clinic of Budapest University, Gál was able to obtain improvement for 3 years in one of 5 cases which were treated with combined radium and X-ray therapy.

Heymann, of the Stockholm Radium Institute, reports the largest number of cases. Of 64 patients treated with radium and X-ray therapy, 3 were cured for longer than 5 years; 11 patients who were under observation for a period ranging from 1 to 4 years were improved.

Of 13 patients treated with radium, Bumm reports 4 cured.

Of 9 cases reported by Amreich, 2 were cured with radium therapy, while 2 had recurrence after 2 and 3 years respectively.

Kehrer recommends a combination of surgical and radiotherapy in the treatment of cancer of the vulva. He removes the lymph glands and then destroys the tumor with cautery, and treats the stump with radium.

Proust also claims good results from combined operative and ray treatment.

Matthei recommends for cauterization of the cancerous growth deep coagulation by means of diathermy.

In the Brussels Radium Institute, of 11 cases of cancer of the vulva, Delporte and Cahen treated 3 with radium implantation and X-rays; 4 were treated with radium implantation and external radium irradiation. In 4 cases the glands were removed surgically and the tumor treated with radium implantation and high voltage irradiation. The patients were observed for 2 years. At the end of this period, 5 of the 11 patients were alive. The best results were obtained in the last group which included 4 patients treated with surgery and radiotherapy. Three of them are living after 2 years.

SUMMARY

There is no doubt that treatment of cancer of the vulva is a most arduous task. Of the methods of treatment at our disposal, radiotherapy ranks first, not only because it can be used in advanced cases, but also because in most instances its use improves the condition or at least ameliorates the suffering and in a few cases even permanent cure has been secured. In most cases radiotherapy produces a temporary improvement and delays death; at any rate the life of the victim is made tolerable. Even the few cures obtained, to say nothing of the palliative effect which it produces, make radiotherapy indispensable in the treatment of cancer of the vulva.

THE PRESENT DAY TREATMENT OF PLACENTA PRÆVIA[1]

J. P. GREENHILL, B.S., M.D., F.A.C.S., CHICAGO
Attending Obstetrician, The Chicago Lying-in Hospital and Dispensary; Attending Gynecologist, Cook County Hospital; Associate in Obstetrics, Northwestern University Medical School

BY placenta prævia is meant the development of part or all of the placenta in the zone of dilatation of the uterus. We generally consider three degrees of this condition, namely: (1) central or total placenta prævia in which the placenta completely covers the internal os; (2) partial or lateral placenta prævia in which the placenta covers only part of the internal os; and (3) marginal placenta prævia in which the lowest edge of the placenta just reaches the internal os. The strict differentiation of these types should not be made until the cervix is fully effaced and dilated, but we generally institute treatment long before this stage is reached.

INCIDENCE AND ETIOLOGY

The incidence of this obstetrical complication is difficult to determine, because statistics from various parts of the world indicate that in some places it occurs once in 130 cases and in other regions only once in 1,500 cases. The exact cause is unknown but a large number of women have previously had some endometrial disease or disturbance. Multiparæ are affected about ten times as frequently as primiparæ. The more the number of children and the greater the rapidity with which the pregnancies follow each other, the greater is the incidence of placenta prævia.

DIAGNOSIS

The diagnosis of placenta prævia is relatively easy. Textbooks teach that a painless, causeless, uterine hæmorrhage in the third trimester of pregnancy is almost pathognomonic of placenta prævia. Regardless of the amount of blood lost during the first hæmorrhage, unless treatment is instituted, there are recurrences of bleeding each of which is generally greater than the preceding one. Labor usually begins after the second or third hæmorrhage. If on vaginal examination a portion of the placenta is found lying over the internal os, the diagnosis of placenta prævia is confirmed, provided we rule out the very rare instances of prolapse of the normally implanted placenta.

It must be borne in mind that in nearly all cases of placenta prævia, the diagnosis can be made without a vaginal examination. This and even rectal examination may be dangerous procedures because of the serious bleeding which may result. An internal examination should not be made unless all preparations are at hand for the proper and aseptic control of bleeding should this occur. Patients who have a hæmorrhage should be sent to a hospital without preliminary internal examination.

Sources of bleeding other than placenta prævia such as polyps, varicose veins, the bladder, and carcinoma of the cervix can easily be eliminated by a careful examination. However, it may be difficult to differentiate placenta prævia from abruptio placentæ, especially if there is partial separation of a low lying placenta. There may also be confusion with rupture of the uterus, ectopic gestation, and bleeding from a vessel which passes over the cervical os because of a velamentous insertion of the cord. However, most of these conditions make hospital care imperative; hence a physician will do the proper thing if he sends to a hospital all patients who have hæmorrhage from the vagina.

MORTALITY

The mortality from placenta prævia varies considerably in different parts of the world and in different localities of any particular country. According to De Lee the maternal mortality reported from twenty different sources varies from 1 to 19 per cent and the fetal mortality varies from 10 to 80 per cent. Hitschmann, in 1921, collected 6,438 cases and found a total maternal mortality of 6.5 per cent and a total fetal mortality of 40 per cent. However, it is generally agreed that collective statistics are hard to evaluate. Much depends upon the condition of the patient, the duration of pregnancy, the type of placenta prævia, the surroundings of the patient, and the skill of the attending physician.

Most of the maternal deaths in placenta prævia are due to hæmorrhage, septicæmia, and rupture of the lower uterine segment. The fetal deaths are generally due to asphyxia (from diminished or absent blood supply), prematurity, injury during version or extraction, and monstrosities.

TREATMENT

There are four commonly used methods of treating placenta prævia, namely: rupture of the membranes with or without firm packing of the vagina, Braxton Hicks podalic version, the

[1]Read before the Chicago Medical Society, January 16, 1929, and the Portland (Oregon) Academy of Medicine, March 19, 1929.

colpeurynter, and cæsarean section. The type of operation to be performed in any case will depend upon the degree of placenta prævia, whether the patient is in labor or not, the amount of dilatation of the cervix, the surroundings, the condition of the mother and the child, and the skill of the attending physician.

At the outset it may be said that a distinction should be made between treatment in the home and treatment in a hospital. As previously mentioned, every patient who has a placenta prævia should be sent to a hospital. Nowadays with the large number of hospitals available and with the aid of automobiles and auto ambulances, which greatly facilitate and hasten transportation, there is practically no excuse for treating a patient with placenta prævia in her home. Furthermore, unless a woman is bleeding very actively when the physician arrives, it is not necessary to pack the vagina. In the few cases where this is imperative the greatest aseptic precautions should be taken, and sterile, cotton pledgets are much better for packing than gauze. The packing should fill the entire vagina firmly and counterpressure should be made from above with a firm abdominal binder.

If a patient must be treated in her home, a careful vaginal examination should be made, and, if the cervix is undilated, it is best to rupture the membranes and combine this with a firm vaginal pack consisting of cotton pledgets. When it appears that there is sufficient dilatation of the cervix, a Braxton Hicks version should be performed. Complete relaxation of the abdomen and uterus are necessary for this, hence an anæsthetic must usually be given for a few minutes. One foot is brought down with the fingers or with a long placenta forceps. The breech of the fetus is thus used as a tampon to control bleeding. The physician must wait for nature to expel the child and he should not leave the patient until the child and placenta are delivered and all bleeding has ceased. Haste in delivering the fetus through a partially dilated cervix will in many cases result in deep lacerations of the lower uterine segment with much hæmorrhage which is difficult to control. Never should the cervix be dilated rapidly by means of the hand or instruments because extensive tears usually result and death is the frequent termination. Salt solution or a blood transfusion should be given at home as well as in a hospital.

In a hospital the treatment will vary with many conditions. If the patient is in labor and there is complete effacement and dilatation of the cervix, the child should be delivered by forceps or version and extraction, depending upon the station of the head. If the cervix is not completely dilated, and there is not much placental tissue over the internal os, rupture of the membranes may suffice. If the child is dead or not viable and there is considerable placental tissue over the cervix. a Braxton Hicks version may be performed and a leg brought down. Extraction should not be completed until the cervix is sufficiently dilated to permit very easy extraction of the fetus. This treatment is identical with that which can be carried out in a home for similar conditions. However, in a hospital if the child is alive, a metreurynter may more properly be inserted into the lower uterine segment after rupturing the membranes or tearing through the placenta. The bag should be sufficiently large, so that after it is forced through the external os there will be enough dilatation of the cervix to permit passage of the fetal head or easy version and extraction. A liberal amount of mercurochrome, hexylresorcinol or other safe antiseptic should be poured into the vagina preparatory to and with the insertion of the bag as well as for any manipulation through the vagina.

Very little traction should be made on the bag, and pituitrin should never be given before delivery of the child. The physician must carefully watch the patient and determine, especially by rectal examination, the exact time when the bag is almost ready to be expelled from the cervix. Preparations should then quickly be made for delivery because not infrequently there is considerable bleeding after the bag slips through the cervix. If the head follows the bag through the cervix, the baby should be delivered without delay either by permitting it to come out spontaneously or with the aid of forceps. If, however, the head remains high, version and extraction should be performed, provided there is sufficient dilatation of the cervix. If there is incomplete dilatation, version alone should be performed but not extraction, because a rupture of the lower uterine segment might result.

The treatment of the third stage is very important because additional hæmorrhage at this time, even though small in amount, may be fatal to the patient. If there is little bleeding one may safely wait for spontaneous separation of the placenta. If, however, there is active bleeding, the placenta should be removed manually, but under the strictest aseptic precautions. The patient may be saved from a death due to hæmorrhage but she may die of sepsis, unless the technique of invading the uterus is as perfect as possible. An antiseptic such as mercurochrome or hexylresorcinol may here be used advantageously. If bleeding continues after removal of the placenta, one must make certain there is no rupture of the uterus. If there is none and pituitrin fails to arrest the

hæmorrhage, the uterus and vagina should be packed firmly without delay. Rupture of the uterus may be treated by tamponade or by laparotomy, depending upon the conditions present, but preferably by laparotomy.

Another expedient of controlling hæmorrhage, which is relatively simple and safe, is temporary clamping of the uterine arteries from below, by means of bullet forceps placed on the broad ligaments (Henkel) or ligation of these arteries with sutures (H. Miller-Kerwin). Likewise, compression of the aorta with the hand, or an aorta compressor applied for a few minutes, may enable the physician to make preparations for the control of hæmorrhage.

Occasionally a patient refuses to have the uterus emptied because the child is not viable. One may temporize only if the bleeding is slight and the patient is willing to remain in a hospital until she is delivered. The uterus should be emptied as soon after viability as possible. The risk of repeated and more profuse hæmorrhages is too great to permit a patient to remain at home and even in a hospital undelivered.

The most modern treatment of placenta prævia is by means of cæsarean section. A few individuals like Duehrssen, Doederlein, Essen-Moeller, and E. Martin employ the vaginal route; but most obstetricians who deliver placenta prævia patients by cæsarean section employ the abdominal route.

According to De Lee, four objects should be accomplished in the treatment of placenta prævia, namely: the hæmorrhage should be stopped, the uterus emptied, hæmostasis insured, and anæmia combated. The most certain way to empty the uterus, control the bleeding during delivery, and prevent postpartum hæmorrhage is abdominal cæsarean section. This operation combined with blood transfusion before, during, or after the operation, yields better results than does any other procedure used in the treatment of placenta prævia. At the Chicago Lying-in Hospital, the total maternal mortality in a series of 118 cases of placenta prævia was 2.6 per cent. Of the 3 deaths, one followed spontaneous delivery and the two others occurred after version and extraction. Cæsarean section was performed 42 times, and there was not a single maternal death in this group. Hence the mortality for the so-called conservation methods was 3.9 per cent. Eight of the cæsarean sections were classic and 34 were low, cervical ones.

Bill recently reported a series of 45 cases in which cæsarean section and transfusion were not very frequent and in which the maternal mortality was 11.1 per cent. He compares this group with a series of 56 cases in which 71.4 per cent were delivered by cæsarean section, with only one death (1.78 per cent). Blood transfusion seemed to be indicated in about one-fifth of these cases.

Frey, in Zurich, reported a series of 88 consecutive cases of placenta prævia all of which were delivered by cæsarean section and only one mother died. The cause of death was an inoperable gastric carcinoma and ileus. In the discussion of this paper Labhard said in an almost similar number of cases treated by abdominal operation, he did not lose a single mother.

In Germany the number of advocates of cæsarean section for the treatment of placenta prævia has recently increased considerably. Not only are clean cases being treated by abdominal operation but also those in which vaginal examinations were made without regard to asepsis. In a series of 168 cases of placenta prævia von Mikulicz-Radecki reported a maternal mortality of 11.5 per cent for the older methods and only 3.3 per cent for cæsarean section. In a recent paper Korthauer points out that in his series, the maternal mortality for patients delivered by version and extraction was 50 per cent; for those delivered by Braxton Hicks version, 11.1 per cent; and for those on whom cæsarean section was done only 6.9 per cent.

Siegal advocates abdominal cæsarean section for placenta prævia in every case which has advanced beyond the thirty-second week, regardless of whether the child is dead or alive, to avoid danger to the mother. The danger consists in laceration and lack of retraction of the isthmus, which can occur whether the fetus is dead or alive. Kellogg, of Boston, believes that all patients with central or partial placenta prævia are best treated by abdominal cæsarean section whether the baby is viable or non-viable, living or dead.

From the foregoing it appears that cæsarean section yields the best results in the treatment of placenta prævia for patients who are in hospitals and in the hands of specialists. We at the Chicago Lying-in Hospital advocate the cervical type of operation (laparotrachelotomy), because of its numerous general advantages over the classic operation. At this hospital in a series of 807 cervical cæsarean sections, there were only 9 deaths from all causes, an incidence of 1.1 per cent. I, personally, have performed 101 low cervical cæsarean sections without a single maternal death. This series includes private patients, patients seen in consultation, and ward patients treated at the Chicago Lying-in Hospital. The cervical section permits careful inspection of the lower uterine segment which is the usual source of the severe hæmorrhage in cases of placenta prævia. Not infrequently a large torn sinus

will be found in the lower uterine segment, and bleeding from this sinus can easily be controlled by suture. Such bleeding sinuses can seldom be seen during the course of a classic operation and they may continue to bleed not only during, but also after the operation. There is no more reason to fear encountering the placenta when performing the low operation than when doing the classic one. If there is a strong suspicion of infection in a patient who has a number of living children it is wiser to perform a Porro operation. The recovery is then much smoother. If definite infection is present and a cæsarean operation is done, the uterus should be amputated regardless of the number of living children the patient has, unless one is willing to perform the Gottschalk-Portes exteriorization operation.

Because of the not infrequent association of fetal monsters with placenta prævia as shown by the author, one should not too strongly advocate abdominal operation in the interest of the baby without first making reasonably certain it is not a monster. At the Chicago Lying-in Hospital during the past 9 years, almost half of the monsters encountered were associated with placenta prævia. This condition can usually be detected by means of an X-ray picture. If a patient has a central or partial placenta prævia and has lost a great deal of blood, a cæsarean section should be done even in the presence of a monster, because the operation is performed in the interests of the mother and not the child. If a patient has suffered much loss of blood, she should be transfused, preferably before operation. If a blood transfusion is not deemed necessary or cannot be given, glucose or saline solution should be administered subcutaneously or intravenously. Furthermore, to eliminate an additional serious risk, local anæsthesia should be used wherever possible. Even if a Porro operation is necessary this also may readily be performed under direct infiltration anæsthesia as described.

All danger is not over with the operation. The patient must be watched for postpartum hæmorrhage, but this rarely occurs after the cervical cæsarean section. Sepsis is another serious complication and this likewise is much less frequent following laparotomy than after extensive vaginal manipulation. Transfusion should be repeated if necessary.

SUMMARY

In recapitulation I should like to urge that all patients who have a painless, causeless hæmorrhage in the last trimester of pregnancy be immediately sent to a hospital without having a vaginal examination made and without a vaginal pack unless this is absolutely necessary. Because of paved roads, smooth-running automobiles, and the large number of accessible hospitals, there is seldom need to treat a patient with placenta prævia in her home or to pack the vagina before sending her to a hospital. I believe the best treatment for cases of central or partial placenta prævia is the low cervical cæsarean section under local anæsthesia. Blood transfusion should be thought of and used more frequently than it is today. In infected cases the uterus should be amputated after the baby is removed. For cases of marginal placenta prævia and for a certain proportion of cases of partial placenta prævia, the older methods such as rupture of the membranes, with or without vaginal tamponade, Braxton Hicks version, and metreurysis should be employed. As De Lee points out, in former years when confronted with a case of placenta prævia, we first thought of the old methods of treatment and only lastly of cæsarean section. Now the process is reversed for we usually think of cæsarean section first.

In this paper little consideration has been given the child because it is secondary in importance to the mother. However, cæsarean section is the most certain way of delivering a baby alive, and it will save every baby which is not too premature or a monstrosity. In cases of central or partial placenta prævia with severe hæmorrhage, the abdominal route is advocated regardless of the condition of the child. Placenta prævia is unfortunately one of the conditions which will continue to occur for a long time, because as yet, we know no certain way of preventing it. Our aim, therefore, is to prevent loss of life, and this can best be accomplished in severe cases by the cervical cæsarean section.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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JANUARY, 1930

ANÆSTHESIA

WHEN I began the practice of medicine, chloroform was the anæsthetic in general use. In the medical profession there was a feeling, perhaps well founded, that if a patient was suffering at the time the operation was performed, so that the pain produced a greater effect on the patient's mind than the fear of the operation, chloroform, if given by the drop method, was a safe anæsthetic. This was considered especially true in obstetrical procedures. It was quite noticeable, however, that when chloroform was given for surgical purposes, the most responsible man gave the anæsthetic. I was never quite sure whether this was because of his supposedly greater skill or whether it was to satisfy the relations and friends, if a catastrophe occurred, that everything had been done that could be done.

Chloroform was looked on as a special danger to the heart. On one occasion when I supposed that the anæsthetist was using ether, two patients had failure of respiration from which they nearly died, and it was not until I was operating on the second patient that I noticed the odor coming from the anæsthetic was that of chloroform and not ether. In neither of these cases did the heart show serious reduction in volume or rate.

In the early days of surgery the A. C. E. mixture was popular as an anæsthetic. It consisted of one part of alcohol, two parts of chloroform, and three of ether, and was given by the drop method. Later, ether came into favor and eventually became the anæsthetic of choice, but at times it caused irritation of the bronchial tubes and the throat, and usually was followed by nausea and vomiting.

For short operations, nitrous oxide was popular, but gave little or no relaxation, and for abdominal work had to be combined with morphine or ether or other anæsthetic.

Recent advances in methods of inducing anæsthesia have brought, in ethylene, a splendid and safe anæsthetic, which is much less irritating than ether, but which does not produce quite so complete relaxation. It can be readily combined with ether, or can be used to follow nitrous oxide, and although it has the disadvantage of being extremely inflammable, in a period of years we have had no accident of any kind from its use.

Acetylene has a field of usefulness, especially for certain operations on the chest.

In those patients in whom breathing is more or less interrupted during the administration of any anæsthetic, Lundy has demonstrated the great value of the use of carbon dioxide to stimulate respiration.

Lundy and McCuskey and their coworkers have found the use of combinations of general anæsthetics of various types, especially of ethylene with ether or nitrous oxide, in

connection with local anæsthetics, to be the procedure of choice in a very considerable number of cases.

In all cases, liberal amounts of oxygen have been found advantageous.

The lungs have nothing to do with inducing anæsthesia, so far as sleep and relief from pain are concerned, except as an entry way through which the inhaled anæsthetic substance passes into the blood stream whence it is carried to the central nervous system. In this process irritation may arise in the lungs, possibly causing serious pulmonary complications.

With the new anæsthetics, for instance, the sodium salts of the barbituric acids and others of that type, we at least have achieved a scientific method of injecting the anæsthetic intravenously, thereby relieving the lungs and other organs of certain dangers to which we have become so accustomed as almost to have forgotten the reason for their existence. This agent is not the perfect anæsthetic, but in several hundred cases, in which it has been used, we have had no fatalities that could be traced to the anæsthetic.

Our experience with sodium iso-amyl-ethyl barbituric acid demonstrates that direct methods of producing anæsthesia may soon be expected, which in connection with approved methods of inducing regional anæsthesia, will relieve the patient of unnecessary dangers to unoffending organs. Certainly, as far as sodium iso-amyl-ethyl barbituric acid is concerned, the speed with which the patient drops asleep and the freedom for some hours after operation from all painful sensation has led many patients who have had unpleasant experiences with general anæsthetics to plead to be operated on under this newer form.

Regional anæsthesia by procaine has a large and growing field of usefulness, and is efficient and safe. Spinal anæsthesia induced by procaine has proved of very great value in operations on those organs which lie below the diaphragm, and this form of anæsthesia is the one that should be used in cases of intestinal obstruction, because in this condition, even if the contents of the stomach have been thoroughly removed by tubing previous to giving a general anæsthetic, antiperistalsis may occur, regurgitating back into the stomach, œsophagus, and pharynx a quantity of intestinal secretions which may be aspirated into the lungs, causing fatal bronchopneumonia, or even drowning on the operating table.

Spinal anæsthesia has the great advantage in cases of probable intestinal obstruction that if no true mechanical obstruction exists, gas and perhaps intestinal contents will pass by the rectum within 15 or 20 minutes. Therefore, if gas and intestinal contents are not passed after a spinal anæsthetic has been administered, mechanical obstruction may be assumed to be present and advantage can be taken of the anæsthesia for immediate operation.

W. J. MAYO.

UNDIAGNOSED HYPERTHYROIDISM

HYPERTHYROIDISM in patients with easily recognized goitrous thyroid glands is not difficult to diagnose. The abundance of literature on goiter has made the medical profession as a whole familiar with the symptoms which characterize the disease. The patient with hyperthyroidism who passes through the hands of many physicians and whose condition remains undiagnosed, is one in whom the symptoms of the disease are not clearly defined and perhaps some are absent. It is not uncommon, however, to lose sight of the fact that two or more diseases may exist simultaneously in the

same person. A great many patients have been, and are, treated for heart trouble because of a rapid pulse. A careful study of this group of patients not infrequently discloses cases of hyperthyroidism of comparatively long standing.

Some of the most striking cases of hyperthyroidism associated with other diseases are those which are occasionally precipitated by a surgical procedure other than thyroidectomy. Some such cases have been observed. In one patient, who had been subjected to partial gastric resection for ulcer, the pulse rate was 160 each minute on the second postoperative day. Hæmorrhage, delayed shock, and peritonitis were all considered and satisfactorily ruled out. The patient's temperature was 101.6 degrees F. In spite of this slight elevation of temperature, the chief complaint of the patient was intolerance of heat, and nervousness, neither of which he complained of before operation. These symptoms suggested the possibility of hyperthyroidism. Examination of the thyroid gland showed it to be barely palpable. Nevertheless, the more common causes of such symptoms following surgical procedures had been ruled out and large doses of compound solution of iodine were administered. Within 48 hours the pulse rate had decreased to 100 each minute, the nervousness had markedly subsided, and general improvement was evident. Administration of iodine was continued for 2 weeks, when the metabolic rate was determined and was found to be +26 per cent. A few weeks later, partial thyroidectomy was performed. The thyroid gland was the site of diffuse parenchymatous hypertrophy. A careful review of the patient's history disclosed the fact that for several years symptoms characterizing peptic ulcer had been present. The patient had become slightly nervous and had lost weight 2 months before operation. These were not outstanding features of his history and were possibly attributed to the peptic ulcer.

Another similar case was that of a young woman who was operated on because of acute purulent appendicitis. All the classical symptoms of this condition were present. Three days after appendectomy, a pulse rate of 170 and a temperature of 102.6 degrees F. suggested the diagnosis of peritonitis. The extreme nervousness and tachycardia led to a diagnosis of exophthalmic goiter. The gland was only slightly palpable. Treatment with iodine was begun, and 3 weeks later partial thyroidectomy was performed. Microscopic study of the removed gland gave the characteristic picture of exophthalmic goiter.

These two cases emphasize the importance of the fact that hyperthyroidism may be present to a mild degree in association with some other disease. A surgical procedure in such cases may precipitate hyperthyroidism which, if not recognized and treated, will eventuate in crisis and perhaps death.

C. F. Dixon.

MASTER SURGEONS OF AMERICA

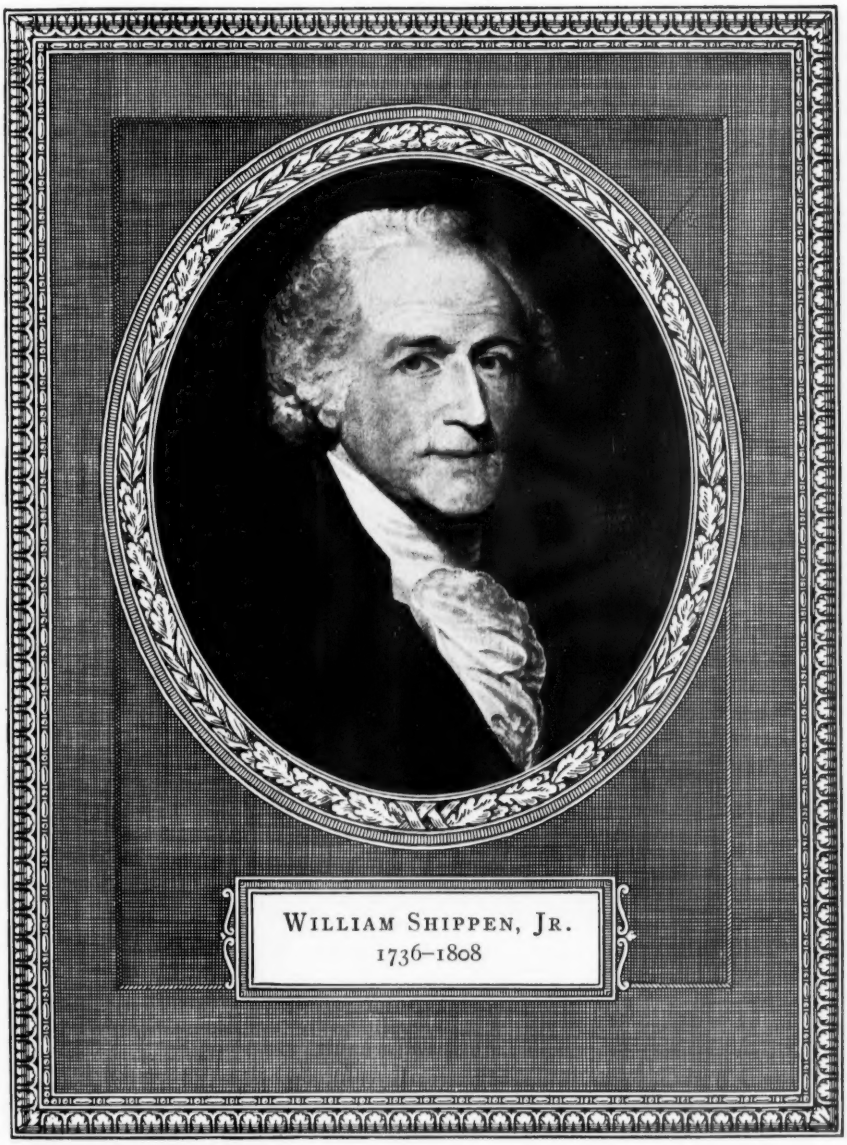
WILLIAM SHIPPEN, JUNIOR

WILLIAM SHIPPEN, Junior, was born in Philadelphia in 1736, the son of Dr. William Shippen, who was the grandson of that Edward Shippen who emigrated from Massachusetts to assist William Penn in founding Pennsylvania, of which colony "he filled, successively, almost all the important offices of the government."

William Shippen, senior, studied medicine in America under a preceptor only, but he attained success and eminence in his profession. Always a friend of learning, he was one of the founders of the College of New Jersey (Princeton) and long a trustee; was a trustee in the College of Philadelphia (Univ. of Penna.) vice president of the Philosophical Society, and the first physician appointed to the Pennsylvania hospital. He saw to it that his son received the best educational opportunities. That son was sent to Nottingham Academy where he came under the instruction of Reverend Mr. Finlay, who gave him solid grounding in the classics. Later he attended the College of New Jersey, where he shone in classical learning and in oratory and became valedictorian for his class, that of 1757. Upon this occasion his Latin oration was delivered with such eloquence that the famous preacher Whitefield, who was present, was moved to praise the young man extravagantly and to urge him to enter the ministry. Instead, he returned to Philadelphia and for three years studied medicine with his father. At the conclusion of that period he went to London, where he lived in the family of John Hunter and studied anatomy and midwifery under William Hunter. Later he went to Edinburgh, where he graduated in 1761, his thesis being entitled "*Dissertatio anatomico-medica de Placentæ cum Utero Nexu.*"

In 1762 he returned to Philadelphia and took up practice and teaching. His return was preceded by a gift to the Pennsylvania Hospital from Dr. John Fothergill, of a set of handsome anatomical paintings and a letter which indicated that Fothergill expected Shippen to explain these pictures and use them in teaching. He also spoke of the probability that Shippen would establish a medical school, and spoke of Dr. John Morgan as Shippen's able young assistant in the project.

Shippen began to teach anatomy at once, and in his opening lecture he proposed the establishment of a medical school. He also lectured on midwifery.



WILLIAM SHIPPEN, JR.
1736–1808

Morgan did not return to Philadelphia for three years, but when he did so, in 1765, he was armed with a strong letter from the proprietor, Thomas Penn. He proposed the establishment of a medical school, in a speech the delivery of which used two days. The trustees of the College of Philadelphia accepted the proposal and Morgan was elected professor of theory and practice of physic.

Shippen thereupon wrote to the trustees, reminding them that the establishment of a medical school had been his dearest wish for seven years, that he had proposed the matter in 1762, and asking the appointment as professor of anatomy and surgery. This was granted. It seems clear that there was a rivalry between Morgan and Shippen for the honor of being founder of the medical school and Father of American Medicine. It is not highly improbable that the continuance of this rivalry led to the quarrels between these men in Revolutionary days and possibly to the scandalous charges and other troubles experienced by each as director general of the Hospital. Except to note that both men were highly successful and highly esteemed during all the period, we may skip the interval from the founding of the medical school until the Revolutionary War.

In October, 1775, Dr. Benjamin Church having been detected in correspondence with the enemy and dismissed from office, Dr. Morgan was appointed by Congress to succeed him as director general and physician in chief of the Hospital. Some months later, in July, 1776, Dr. Shippen was appointed director of the Hospital of the Flying Camp in New Jersey.

Soon after, Congress began to curtail Morgan's power and authority and to increase those of Shippen, and in January, 1777, Morgan was dismissed, and Shippen was given his position as director general in April.

Morgan at once began to seek vindication, which Congress granted him in 1779 in a resolution declaring that he "did conduct himself ably and faithfully in the discharge of his office." Morgan, Benjamin Rush, James Tilton, and others continued to make serious charges against Shippen, who was brought to trial before a military commission in August, 1780, and was honorably acquitted. In January, 1781, he resigned from the service and returned to private practice and teaching. Except for one winter, 1776-7, he had kept up his lectures each year while in the army. He was considered an extraordinarily fine lecturer. Success in teaching anatomy and obstetrics required outstanding personality, as public opinion did not approve of dissection or of men midwives. On one occasion Shippen issued the following public statement as to his procurement of anatomical material. "The Doctor with much pleasure improves the opportunity to declare that the report is absolutely false, and to assure them (the public) the bodies he dissected were either of persons who had wilfully murdered themselves, or were publicly executed; except now and then one from the Potters' field, whose death was owing to some particular disease, and that he never had one body from the church, or any other private burial place."

The advertisement for his first course of lectures on midwifery began as follows:

"Dr. Shippen, Jun., having been lately called to the assistance of a number of women in the country in difficult labors, most of which were made so by the unskilled old women about them; the poor women have suffered extremely and the little ones were entirely destroyed, whose lives might have been easily saved by proper management; and being informed of several desperate cases in the different neighborhoods which had proved fatal to the mothers, as well as their infants, and were attended with the most painful circumstances, too dismal to be related; he thought it his duty immediately to begin his intended course of lectures on midwifery, and has prepared a proper apparatus for that purpose, in order to instruct those women who have had virtue enough to own their ignorance, and apply for instruction, as well as those young gentlemen, now engaged in the study of that useful and necessary branch of surgery, who are taking pains to qualify themselves to practice in different parts of the country, with safety and advantage to their fellow creatures."

After lecturing and practicing medicine, surgery, and obstetrics for some ten or twelve years after leaving the army, Shippen suffered a severe blow in the illness of his only son, a young man of charming personality and brilliant promise, in whom he delighted and for whom he lived. After six years of illness this son died and Shippen lost interest "in every remaining object."

"Then like a lamp within him died
The flame of his magnificence."

For another ten years he lived and taught but mainly he gave himself up to religion. His health failed and in the summer of 1808 he was "attacked by an anthrax, which so much increased his debility that he sunk under it on the eleventh of July."

He was learned, eloquent, equable, and kind. He had a pleasing personality and a fine sickroom presence. He guided the medical department of the American Army during a considerable part of the Revolutionary War. He was a co-founder of the first American medical school, a noted and pioneer teacher, a skilled surgeon and obstetrician. He looms large in the history of American Surgery.

P. M. ASHBURN.

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CÆLIUS
AURELIANUS
DE
MORBIS ACUTIS ET
CHRONICIS
AMSTELAEDAMI
Apud WETSTENIOS
cIↃ IↃcc IX.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN, M.D., F.A.C.S., OMAHA, NEBRASKA

CÆLIUS AURELIANUS

ORIGINALITY or at least some difference with or progress beyond accepted methods and beliefs is necessary to accomplish reputation for any individual and make that individual an outstanding figure. Cælius Aurelianus chose for his life work a profession which at his time was dominated and had been dominated for more than a century by the teachings of Claudius Galen. To him there were open three opportunities. Either to become a follower of the Galenic doctrines of eclecticism and sink into the level of mediocrity by becoming an infinitesimal grain of sand in a great mass; or to adopt one or another type of the numerous forms of charlatanry of the period and lose his self respect if not his originality; or to find some other outlet for his mental effort and so hew out a career for himself which would permit him some autonomy and also allow him to achieve some reputation for himself. Of the three openings, Aurelianus chose the latter and solved his problem by becoming a follower of the greatest competitor of Galen, Soranus of Ephesus. Incidentally he preserved for us some of the work of Soranus and gave us in his work one of the best descriptions of the beliefs and practices of the sect of the Methodists which had been founded by Asclepiades of Prusa in the first century B.C., changed, not particularly for its benefit by Themiston a little later in the same century, continued by Soranus at about the time of Galen, and then overshadowed by the popularity of the Galenic school.

Cælius Aurelianus was an African, born at Sicca in Numidia, who lived about the end of the third and beginning of the fourth century A.D. He came to Rome and there practiced and taught medicine and surgery and achieved a considerable reputation both from his writings and his success in practice. His work became one of the principal guides followed by the medieval monks and is the principal authority that we now have for the views and principles of the Methodist school as it existed during the closing years of the Roman period.

It was not until well along in the sixteenth century, 1529, that Aurelianus' work was printed, and then only in part. In that year the *Five Books of Chronic Diseases* was published in folio at Basle by Henricus Petrus. Four years later, in 1533, the *Three Books of Acute Diseases* was printed in Paris by Simon de Colines of the Stephanus Press, the step-father of Robert Estienne. Fourteen years later Aldus included the *Five Books of Chronic Diseases* in the Aldine medical collection which appeared in 1547 under the title *Medici Antiqui Omnes. The Acute and Chronic Diseases* was published in one volume for the first time in 1567 and again in 1569 at Leyden by William Rovillius. These editions evidently supplied the demand for more than a century and it was not until 1709 that a Swiss physician, residing in Holland, Johann Conrad Amman, brought out a new and most complete edition of the works of that author. Amman is noted also for his work on the education of the deaf, and in 1692 he published a treatise on this subject which was written in Latin and achieved such a reputation that it was translated into Dutch and English.

This work of Cælius Aurelianus is practically the only one which gives the ideas and teachings of the Methodist school as it is frankly a translation into Latin of the work of Soranus of Ephesus which has in great part been lost in the original. Aurelianus was an African, consequently his Latin is not particularly good and the book is by no means a model, but in spite of these drawbacks it is important for its historical value and the fact that even as late as the Salernitan School it held its position almost on a par with the works of Hippocrates and Galen when they were read and taught to the students of medicine. Thus the three great schools—Dogmatic, Eclectic, and Methodist—were represented by these three authors in the teaching of the middle ages.

The greater part of the work deals with internal medicine and contains much pharmacology together with baths, enemata, and other therapeutic devices used in that form of practice. He does however, occasionally advise surgical procedure such as tracheotomy, which he refers back to Asclepiades but that he is not very enthusiastic about operative procedures may be gathered from his description of hernia. He speaks of cases in which the hernia goes into the scrotum and apparently becomes strangulated. For this he advises the attempted replacement by various means and finally says that the sac may be opened and replacement carried out by "audacissima chirurgia" (most audacious surgery).

In the field of descriptive symptomatology of disease the work is good. The description of Hydrophobia is both exhaustive and excellent and the same may be said of many other diseases. One concludes from the book that Soranus was a clear and accurate observer and that at the least Aurelianus did a great service in preserving his work.

REVIEWS OF NEW BOOKS

THE subtitle of the new contribution on *Progressive Relaxation*[1] is "A Physiological and Clinical Investigation of Muscular States and their Significance in Psychology and Medical Practice." This is the product of twenty years' work and comes from the physiological laboratory of the University of Chicago. It is a most scholarly and scientific presentation and review of existing knowledge and contains the carefully developed argument for a new approach to "nervousness" together with exact details of the author's technique of treatment.

The book contains eighteen chapters with an extensive bibliography and index. The author first calls attention to the hitherto lack of exact physiological knowledge of rest and relaxation. He defines neuromuscular or nervous hypertension as "a condition marked by reflex phenomena of hyperexcitation and hyperirritation." He suggests that the term "nervous hypertension" should largely replace the term "neurasthenia." He believes that in most instances the exhaustion implied in neurasthenia is a biproduct of tension. The appearance of phenomena of nervous hypertension in various diseases throughout the whole range of medicine and surgery is well discussed. The extreme degree of relaxation required for success is termed "progressive relaxation." "Differential relaxation" is the absence of an undue degree of contraction in the muscles employed for an act, while other muscles, not so needed, remain flaccid. Sixty pages are devoted to the technique of inducing these states. Chapters on the influence of relaxation upon the reflex reaction to sudden pain, upon the knee-jerk, and upon mental activities, though models of careful scientific work, are highly technical and difficult for any but workers in physiology. There is a similarly excellent discussion of tonus. A special chapter is devoted to the application of the author's method in spastic œsophagus and mucous colitis. Illustrative cases in diverse medical conditions and the therapeutic use of progressive relaxation complete this volume.

The neurologist or psychiatrist with adequate clinical experience in neuroses will be surprised at the complete and consistent absence of the psychotherapeutic viewpoint. Dr. Jacobson has even gone to great care to avoid any effects explainable by suggestion. It is argued that "during neurosis, there is failure to relax. Recovery, by whatever route attained, generally is characterized by a return to a fairly normal relaxed state. The various methods to this end heretofore have been indirect in the measures employed, perhaps because the importance of physiological relaxation has not been fully realized." To the reviewer there appears to be a question of priority. Granted some distressing experience leading to emotional disturbance, such as a fear which is built on certain misinterpretations, there will be neuromuscular tension; this in turn will send to the brain proprioceptive impulses which in turn will increase the tension; and a vicious circle of habitual state will result. Where is the chief offender in this vicious circle? Alteration of mental content, attitude, or viewpoint often results in lowered tension. It is impossible to conceive that any alteration of tension can correct misinterpretations or banish fears based thereon. Taken as an independent method of treatment, Dr. Jacobson's contribution challenges the whole mental hygiene position. Taken as an adjunct in re-education, new habit-formation, and better physical hygiene, after psychic data are adjusted, it is full of promise of great value.

JOHN FAVILL.

THE authors of *Gonorrhea and Kindred Affections*[2] have endeavored to produce a short and practical work to be used by both the specialist and the general practitioner. A short concise history of gonorrhœa is given and a plea is made for checking the incidence of gonorrhœa by teaching boys the proper respect for women and themselves, but prophylaxis and regular medical examination of prostitutes are not stressed. Even though the American and foreign authors are paying less and less attention to the complement fixation test, it has a certain definite value and should be used. The statement that no absolute immunity is gained from an attack of gonorrhœa; and that 90 per cent of the cases of gonorrhœa becomes posterior even with the best of care, may be somewhat explained by the fact that the author uses the "sealed in" treatment for early anterior urethritis. Posterior urethritis he believes does best when the methods of treatment and the solutions used are changed from time to time. He advocates that when massaging a prostate it is best to pass the finger to the limit of the right or left lobe of the prostate and massage outward and downward; never from side to side across the urethra. The criteria for the cure of gonorrhœa in the male should be nine gonorrhœa-free smears and cultures of the urethra following massage, sounds, vaccine, and silver nitrate. In addition to this the patient is urethroscoped and the urine cultured. This is all repeated after a week's rest and again after a two weeks' rest. A complement fixation test is done last. The author states that he has not seen the disappearance of gonococci in patients after attacks of high fever. He furthermore believes that the gonococcus remains many years in the epididymis after it has once been attacked.

[1] PROGRESSIVE RELAXATION; A PHYSIOLOGICAL AND CLINICAL INVESTIGATION OF MUSCULAR STATES AND THEIR SIGNIFICANCE IN PSYCHOLOGY AND MEDICAL PRACTICE. By Edmund Jacobson, A.M., Ph.D., M.D. Chicago: University of Chicago Press, 1929.

[2] GONORRHEA AND KINDRED AFFECTIONS; GONORRHEA IN THE MALE, CHANCROID AND VERRUCA ACUMINATA. By George Robertson Livermore, M.D., F.A.C.S. GONORRHEA IN THE FEMALE, AND THE INFECTIOUS GRANULOMATA. By Edward Armin Schumann, A.B., M.D., F.A.C.S. New York and London: D. Appleton and Company, 1929.

Chemotherapy is of no value, moreover it may produce harm. Vaccine therapy is of value only in gonorrhœal complications such as prostatitis, epididymitis, and arthritis. Diathermy has proved very unsatisfactory even though the literature gives it much credit, especially in epididymitis. Small incisions for suppurating inguinal adenitis are best. Cocaine of any strength is dangerous and given no place in genito-urinary surgery.

Strictures are carefully dilated to No. 32F. and No. 35F. sounds. The chapter on strictures is very comprehensive and complete.

It is stated that gonorrhœal patients who develop an arthritis are not predisposed to arthritis in their next attack of neisserian urethritis. In the treatment of arthritis typhoid vaccine is used intravenously. The authors do not consider salicylates of value in gonorrhœal arthritis and believe that this is one way to differentiate gonorrhœal arthritis from other arthritides.

The urethra is the site of infection in non-parous women and the cervix in parous women. Six to 8 per cent silver nitrate is used without hesitancy on the acutely infected cervix. Non-operative procedures are stressed in the treatment of salpingitis.

The criteria of cure of female gonorrhœa are normal appearing Bartholin's glands, urethra, paraurethral crypts, vagina, cervix, and anus. A bimanual examination must exclude pathology in uterus and tubes. Smears are taken from a massaged dilated urethra after treatment with silver nitrate. The urine is centrifuged and stained. Smears are also taken from Bartholin's glands, Skene's tubules, the cervix (before and after menses), and the anus. These tests are repeated in 2, 4, and 6 months. If all tests are negative at the end of a year marriage is permitted.

Government education of the people in matters of venereal diseases is advocated.

This book is interesting reading and is quite valuable in that it gives us the ideas of men whose experience has been wide and varied. HARRY CULVER.

EVER since the first installments of *Biology and Pathology of Woman*[1] put in appearance in 1923, I have promised myself the pleasure of presenting to the readers of SURGERY, GYNECOLOGY and OBSTETRICS an appraisal of this stupendous undertaking in its entirety. After less than six years—a short time, indeed, for so gigantic an enterprise—the monumental work is now before us complete. Its fifteen volumes of large format, each of about one thousand pages, represent an encyclopædia of unprecedented proportions; and one's amazement at such riches is still more intensified as one finds that the index covers no fewer than 109 pages, and that the table of contents alone occupies 58 pages.

This table of contents permits a clear insight into the plan of the work.

[1]BIOLOGIE UND PATHOLOGIE DES WEIBES; EIN HANDBUCH DER FRAUENHEILKUNDE UND GEBURTSHILFE. Edited by Prof. Dr. Josef Halban, Vienna, and Prof. Dr. Ludwig Seitz, Frankfurt. Berlin and Vienna: Urban & Schwarzenberg, 1923 to 1929.

The first volume contains chapters on the history of gynecology; normal embryology, anatomy, histology, topography, and physiology of the female uro-genital tract; comparative anatomy and physiology of these organs in domesticated and experimental animals; endocrinology; eugenics; hygiene; and occupational diseases. The second volume deals with general symptomatology and diagnosis; methods of examination; medicinal and organotherapy; protein therapy; X-ray and radium treatment; psychotherapy; pre-operative and postoperative treatment; general and local anæsthesia. The third volume covers the problem of constitution; disturbances of growth; osteomalacia; chlorosis; malformations; malpositions; sterility; sterilization; pathology of menstruation; bacteriology of the vagina; diseases of vulva and vagina. In the fourth volume we read of inflammations; atrophy and hypertrophy of uterus and cervix; disturbances of secretion; hæmorrhages; pathology and treatment of fibroids, cancers, and all other tumors of the uterus. The fifth volume takes up tumors of the tubes; diseases of the pelvic peritoneum, ligaments, nerves, and blood vessels; further, actinomycosis, tuberculosis, and syphilis of the genitals. In the sixth volume tumors of the ovaries and their treatment are discussed; likewise, injuries of, and foreign bodies in, the genitals; peritonitis; and diseases of the breasts. The seventh volume is devoted to psychology and psychiatry in gynecology; the interrelations between the female genitals and ear, nose and throat, musculature and bones, digestive, circulatory, and hæmopoietic systems, eye and skin, liver and kidneys; and finally, discusses the sedimentation test. The eighth volume treats of the relationship to infectious and respiratory disorders, metabolism, adrenals, spleen and pancreas, urinary organs, and nervous system; and contains an essay on the physiology and pathology of puberty.

Beginning with the ninth volume, obstetrical subjects are presented. Here we find chapters on the development of the ovum and placenta; anatomy and physiology of the fetus; physiology and pathology of placenta and amniotic fluid. The tenth volume covers the pathology of decidua, membranes, and umbilical cord; biochemistry of pregnancy and parturition; physiology and diagnosis of pregnancy; and uterine contractions. Normal childbirth, multiple pregnancy, abnormal duration of gestation, premature birth and abortion, and toxæmias are discussed in volume eleven. The twelfth volume deals with anomalies of passage and passenger; mole and chorioepithelioma; and ectopic pregnancy. In the thirteenth volume are presented placenta prævia; the third stage; puerperium; uterine rupture; operations during pregnancy; and sudden death in pregnancy, labor, and puerperium. The fourteenth volume is given over to operative obstetrics and the physiology and pathology of the newborn. The final volume rounds out the work by chapters on normal and pathological parturition in domestic animals; medicolegal gynecology; achievements of gynecology

in the nineteenth century; the reticulo-epithelial system in woman; vitamins; fever in labor; and the effect of premature rupture of the membranes on childbirth.

Of this truly imposing array of contributions I have reported many at some detail in numerous previous reviews. Each chapter is a complete essay on the respective subject; some of them represent veritable monographs. To select a few at random, the chapter on medicinal treatment covers 140 pages, that on sterility 164 pages; the two chapters on ovarian tumors have 358 pages; the essay on abortion numbers 240 and the treatise on gynecologic urology 353 pages. The thoroughness of presentation is further attested by thousands upon thousands of bibliographic references, appended in smallest print at the end of each chapter. American literature is well represented except for the years during and immediately after the war when the impoverished condition of the country made our journals inaccessible to German writers.

Ninety-four collaborators have contributed to the work. Almost all of these are men known to the medical world as authorities on the particular subjects they have discussed. Internists and neuropsychiatrists, dermatologists and historians, oculists and veterinarians have labored side by side with gynecologists to make this undertaking complete from every aspect; and it may be said without exaggeration that no better proof of scientific solidarity and co-operation could have been given. That not all the essays and chapters are of equal standard is, after all, only natural with so large a number of collaborators. A certain amount of overlapping and repetition was unavoidable and seems to me even desirable if the various subjects were to be viewed from every possible angle. Neither should it be a matter of criticism if here and there we find opinions expressed which may not be acceptable to everyone; for medicine is no exact science but remains forever in a state of flux, and many of the newer teachings are still debatable while even the older and seemingly established ones are always subject to changes. But it would be quibbling to pick flaws in a work which has given to the medical world an entirely new conception of gynecology.

We have traveled far in the last sixty or seventy years since our young specialty first began to struggle into a place of its own and aspire to independence by the side of its parents, Obstetrics and Surgery. Then, and for many years to come, attention was focused on *local* changes within the reproductive sphere, and our therapy consisted altogether of *local* treatment by means of medicines or the knife. The last two decades have brought about a decided change. Serology and bacteriology, physiology and endocrinology, the study of heredity and constitution, the recognition of the effect of occupation, and the evaluation of psychic influences—all these have widened our gynecologic horizon and enabled us to realize that our endeavors must not be limited to a certain set of organs but should embrace as well the organism which harbors these organs. If we only had a more comprehensive term for this new gynecology in the English language! The Germans have progressed from *Frauenheilkunde* to *Frauenkunde*. To create a work which should collect the entire material and present all the available facts in a clear and consistent manner, that has been the plan of the editors. To quote their own words in the preface, "the work not only describes the diseases of the female generative organs, but also assembles everything that may have a bearing on the origin and treatment of these diseases, from the moment of conception to the grave. Such a work, therefore, must extend its scope beyond that of all previous handbooks in our specialty."

Biology and Pathology of Woman serves a double purpose: To the active specialist it is an authoritative guide; to the researcher, a reference work on all developments to the present day. We now understand the reason why chapters on comparative anatomy, physiology, and pathology of animals are included. Not only is much of our fundamental knowledge derived from observations and experiments on animals, but the detailed description of methods of experimentation saves a good deal of time for those who wish to engage in similar investigations.

For practical purposes, the proposition amounts to this: Whoever embarks on any clinical or experimental study or research on any gynecological or obstetrical subject will, hereafter, consult first the respective chapter or chapters in this handbook. For reasons previously stated, he may have to look up the American literature from 1914 to 1923, and will then be ready to start on his own work.

I have not yet mentioned the illustrations. There is an almost endless number of them, many of which have never before been published, and there is a profusion of color plates of unsurpassed excellence. When one realizes that this work was conceived of and carried into effect at the time of greatest postwar depletion and depression in Germany, the vision, daring, and determination of the editors and publishers excites our sincere admiration. We thank them for what they have given us, and we congratulate them on their success in creating a work of which it is difficult to speak in other than superlativistic terms.

Such a work must not become obsolete. Yet, experience has demonstrated that the most extensive reference works all too soon become antiquated. I mention merely the handbooks by Winckel and by Veit; and it seems that medical evolution takes on more rapid strides than ever before. We trust that the publishers of *Biology and Pathology of Woman* have devised a way to avoid such an issue in this case. Perhaps our own "loose-leaf systems" and monographic collections with their "appendixes" brought out every few years may suggest a way by which this work can always be kept abreast of any progress made and thus be retained as an evergreen classic of gynecologic literature.

From all that has been said, it is quite clear that the many thousands of scientific gynecologists in this country and the world over simply have to have this work, and that without it no public medical library can hope to be complete.

GEORGE GELLHORN.

IN recent years a number of manuals dealing with the subject of electrocardiography have been published. Among these the book of Dr. Wiggers[1] will take high rank. The author has had precisely the experience to which he modestly lays claim, experience in the use of the electrocardiograph in experimental work and in the clinic, and is thoroughly familiar with the physical principles upon which the electrocardiograph has been developed. The early chapters of the book are concerned with the physics, both electrical and optical, of electrocardiography; these are followed by descriptions of the various types of instruments upon the market. The second part is opened with a description of the normal electrocardiogram, following which the significance of the deflections is discussed. Indeed, the chapters on "The Significance of Electrical Deflections" contain within a brief compass a comprehensive survey of fundamental principles in the interpretation of electrocardiograms. The remaining sections are given over to the presentation of the clinical aspects of electrocardiography. In the preface the author states that the plan of instruction used in his courses in the medical schools with which he has been connected has been evolved as a basis for the book. "In fact, a large part was actually written while the practical courses were in progress." This has given to the clinical sections a didactic quality which does not make for the pleasure of reading but it will serve to make it easy for the beginner to retain what he reads, which, after all, is the aim of the author. The book ought to be well received. It is of real value. If there is any criticism to be offered it would be to suggest that another edition may well contain more illustrative electrocardiograms. The clinical sections might be amplified with a wider range of electrocardiograms and thus be of more help to the man who is working out his electrocardiographic problems alone.

JAMES G. CARR.

THE two-volume set on *Otosclerosis*[2] is published under the auspices of the scientific committee of the American Otological Society and represents the first step in an extensive study of the problem of otosclerosis. It comprises about 500 pages divided into four sections dealing with pathology, etiology, symptoms, and diagnosis and treatment. A very exhaustive study has been made of the history and research in this type of deafness. The book is not intended as a text on otology but is a comprehensive review of all available literature to date on otosclerosis. It contains a most extensive bibliography in addition to an author index. It is probably the greatest reference work on otosclerosis to date. JOHN F. DELPH.

IN the foreword of the book entitled *Radium Treatment of Cancer*[3] the author states that the work covers a period of 5 years and embodies the experience of the staff of the Westminster Hospital, which includes nine of his colleagues.

The divisions of the volume are well organized and include a clear and concise explanation of the physics of radium; the general principles of treatment; the technique involved in the application of the doses advocated by the authors; and illustrative cases of the treatment of the most common sites of malignant disease.

The chapters on cancer of the buccal cavity and on the breast will be especially interesting to the general surgeon. In cases of oral cancer the author states that radium therapy of the primary growth should always be the *first step* in the treatment and that surgery should not be directed against the lesion unless the treatment fails.

There has long been a controversy both here and abroad over the amount of radium to be used in a given case. At the present time, some of our largest centers are using great amounts for a short period of time and are thus delivering "gram" doses. At the Westminster Hospital they rely upon small amounts of radium with long time exposures, and the results they have obtained constitute, in my opinion, a strong argument in favor of their method.

The book is well illustrated and in addition contains 13 colored plates, which are excellently done. The chapter on skin covers less than two and one half pages and might well be enlarged. On the whole it is a very good exposition of the subject and I believe it furnishes a valuable and timely link between the surgeon and radium therapist.

R. C. CRAIN.

THE book on *Physical Therapeutic Technic*[4] by Dr. Granger, who was the best known authority on physical therapy in the United States, is the best of its kind that has appeared. It is not for the specialist in physical therapy but is intended for the physician who has installed a limited equipment. Therefore there are rather sketchy chapters on mechanotherapy, muscle re-education, and massage. This is the only serious fault in the book, for the physician using physical therapy should know the technique of muscle re-education.

The first one hundred pages give an excellent description of the use of electrotherapy with some fundamentals of the physics of the various currents.

[1] PRINCIPLES AND PRACTICE OF ELECTROCARDIOGRAPHY. By Carl J. Wiggers, M.D. St. Louis: The C. V. Mosby Company, 1929.

[2] OTOSCLEROSIS; A RÉSUMÉ OF THE LITERATURE TO JULY, 1928. Compiled under the direction of the committee on otosclerosis, American Otological Society. By Norval H. Pierce, M.D., James F. McKernon, M.D., Eugene A. Crockett, M.D., J. Gordon Wilson, M.D., and Arthur B. Duel, M.D., Editor. Vols. i and ii. New York: Paul B. Hoeber, Inc., 1929.

[3] RADIUM TREATMENT OF CANCER. By Stanford Cade, F.R.C.S. (Eng.). New York: William Wood and Company, 1929.

[4] PHYSICAL THERAPEUTIC TECHNIC. By Frank Butler Granger, A.B. M.D. With a foreword by William D. Mc Fee, M. D. Philadelphia and London: W. B. Saunders Company, 1929.

The technique here is well explained and well illustrated.

The value of massage is stressed, and Granger makes a plea that as soon as the physician needs an assistant or a technician the common practice of training an office secretary be abandoned and a person trained in massage and muscle re-education be secured.

There is an excellent chapter on a hospital department of physical therapy, giving suggested lists of equipment and floor plans.

The last two hundred and twenty-five pages are devoted to the technique of physical therapy in various pathological conditions. Here it is emphasized that physical therapy is only an adjunct, that it should be prescribed only after a careful physical examination has been made, that etiological factors should first be sought and eliminated, and that proper medical and surgical procedures should go hand in hand with physical therapy. This is based on twenty-five years' experience in a large private practice devoted to physical therapy and as director of one of the largest hospital physical therapy departments in the world.

This book will be a great help to the beginner and of great interest to those familiar with physical therapy. J. S. C.

GUTZEIT'S monograph[1] is a rather complete discussion of the development and the uses, advantages, and disadvantages of the method of gastroscopy for diagnostic purposes. He has made over 500 gastroscopic examinations and gives the reviewer the impression of having mastered this rather difficult procedure. He gives explicit directions and valuable suggestions for successful carrying out of the method. Though an enthusiast on the subject he frankly admits the disadvantages of the method. Among them he mentions sensitive throat, difficulty in passing a rigid instrument, possible damage to the œsophagus, and perforation of the stomach wall with the instrument. The damage to the œsophagus is particularly to be feared because of great difficulty of approach and repair. The author also states that not all of the gastric area is accessible to view. The lesser curvature and the area of the pyloric portion cannot be brought into the view. Its greatest advantage is in the recognition of a gastritis. So far as ulcer and carcinoma are concerned the roentgen-ray study will always give more reliable information. The method will in all probability find very little favor this side of the Atlantic. GEORGE HALPERIN.

[1] DIE GASTROSKOPIE IM RAHMEN DER KLINISCHEN MAGENDIAGNOSTIK. By Dr. Kurt Gutzeit. Berlin: Julius Springer, 1929.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

GRENZ RAY THERAPY. By Gustav Bucky, M.D. With Contributions by Dr. Otto Glasser and Dr. Olga Bicker-Manheimer. Translated by Walter James Highman, M.D. New York: The Macmillan Company, 1929.

TRADE PRACTICE CONFERENCES. Federal Trade Commission. Washington: U. S. Government Printing Office, 1929.

THE ADRENALS; THEIR PHYSIOLOGY, PATHOLOGY AND DISEASES. By Max A. Goldzieher, M.D. New York: The Macmillan Company, 1929.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. 15th Series. New York: The Rockefeller Foundation, 1929.

THE NERVOUS CHILD. By Hector Charles Cameron, M.A., M.D. (Cantab.), F.R.C.P. (Lond.). 4th ed. New York and London: Oxford University Press, 1929.

TESTICULAR GRAFTING FROM APE TO MAN; OPERATIVE TECHNIQUE PHYSIOLOGICAL MANIFESTATIONS HISTOLOGICAL EVOLUTION STATISTICS. By Serge Voronoff and George Alexandrescu. Translated by Theodore C. Merrill, M.D. London: Brentano's Ltd., 1929.

AIDS TO ORTHOPÆDIC SURGERY. By Eric A. Crook, M. Ch. (Oxon.), F.R.C.S. (Eng.). New York: William Wood and Company, 1929.

LIVRE JUBILAIRE DU PROFESSEUR JEAN VERHOOGEN. Bruxelles: l'Imprimerie Lielens, 1929.

A MANUAL OF MIDWIFERY; FOR STUDENTS AND PRACTITIONERS. By Henry Jellett, B.A., M.D. (Dub. Univ.), F.R.C.P.I., L.M., and David G. Madill, B.A., M.B., B.Ch., B.A.O. (Dub. Univ.), L.M. 4th ed. New York: William Wood and Company, 1929.

SYNOPSIS OF THE PRACTICE OF PREVENTIVE MEDICINE; AS APPLIED IN THE BASIC MEDICAL SCIENCES AND CLINICAL INSTRUCTION AT THE HARVARD MEDICAL SCHOOL. Cambridge: Harvard University Press, 1929.

THE TREATMENT OF THE COMMON DISORDERS OF DIGESTION; A HANDBOOK FOR PHYSICIANS AND STUDENTS. By John L. Kantor, Ph.D., M.D. 2d ed. St. Louis: The C. V. Mosby Company, 1929.

AN OUTLINE OF NEUROLOGY AND ITS OUTLOOK. By Sir E. Farquhar Buzzard, K.C.V.O., M.A., M.D., F.R.C.P. Being the Eleventh Earl Grey Memorial Lecture Delivered at King's Hall Armstrong College Newcastle-on-Tyne, March 11, 1929. London: Oxford University Press, 1929.

THE VALUE OF THE BLOOD AND PLASMA IN HEALTH AND DISEASE. By Leonard G. Rowntree, M.D., and George E. Brown, M.D. With the Technical Assistance of Grace M. Roth. Philadelphia and London: W. B. Saunders Company, 1929.

LA PERMÉABILITÉ ET LES OBTURATIONS TUBAIRES; STÉRILITÉ—INFECTIONS SALPINGIENNES CHIRURGIE TUBAIRE. By Claude Bélère. Préface by Professeur P. Lecène. Paris: Masson et Cie, 1929.

AMERICAN COLLEGE OF SURGEONS

PROCEEDINGS OF THE NINETEENTH ANNUAL CLINICAL CONGRESS

CHICAGO

OCTOBER 14-18, 1929